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Universal Car Tenoning Machine—Automatic Car Mortising and Boring Machine.

On this page and the following one we show two machines intended to work together in the construction of railway cars. They are now on exhibition at Paris, having been recently designed by J. A. Fay & Co., Cincinnati, Ohio. The one on this page is designed for making all kinds of tenons on heavy timbers required in car and bridge building, either single or double, also for cutting gains on heavy pieces, and for cutting-off purposes. It is said to be the most powerful machine for the purpose ever constructed. The design is somewhat peculiar, the main frame being in the form of a goose-neck, with a deep gap formed across the column for the passage of timbers endwise between the cutter heads; the column is massive and heavy, and cast in one entire piece, as is also the sole plate or bed upon which the carriage works.

It has a very large range, is adapted to a large variety of work, and is truly universal, as it will make single or double tenons, and, with the application of a gaining head upon the top spindle, do all kinds of over-gaining, or, by placing a gaining head upon the lower spindle, will do all kinds of under-gaining on the ends, or, by extending the timber through the gap of the machine, will cut on any portion of it that may be required.

By the removal of the lower cutter-head and the substitution of a circular saw, it is adapted for all purposes of heavy cutting-off. It has another head mounted upon a vertical spindle, in bearings gibbed on the inner side of the column in the rear of the tenoning heads, for producing double tenons. This head is adjustable up and down, and is arranged to cut to a line or point, coincident with the cutter plane of the lower tenoning head.

The tenoning heads run on heavy steel shafts, in large, self-lubricating bearings, which are cast to a cross-slide that is gibbed to the face of the column above and below the gap. They carry wide knives, and will cut tenons up to 6″ at one operation, or, by repassing of the material, any length of tenons desired can be made. Both have a vertical motion, simultaneous or independent, while the upper cutter has an additional end adjustment for making one tenon longer than the other. The cutter-heads are belted by a novel system, which secures an open gap for the passage of long timber.

The carriage is self-operating, being driven by a screw actuated by friction gears, the simple pressure of a lever causing it to travel in either direction, or it can be instantly stopped. On heavy timber and long work the power feed will be found desirable. On short work it can be disengaged, and the carriage operated by hand. The countershaft which drives the spindle for cutting the vertical tenons is placed in the rear of the machine.

The tight and loose pulleys are 12″x6″, and should make 700 revolutions per minute.

The automatic, hollow-chisel, car-mortising and boring machine, shown on page 2, is a powerful and compact machine, designed for freight car work. The principle upon which the mortises are made is that known as the hollow-chisel, with an internal rotating auger, which has been employed for about thirty years. Its previous adaptation has been confined to lighter purposes, such as sash, doors, hubs, agricultural implement work, etc., but more recently to the heavy mortising required in freight car building. It is automatic in operation, lays out its own work by means of stops, and works with great rapidity upon any kind of timber, hard or soft.

The chisel bar is carried in a heavy frame, which has a horizontal traverse movement to and from the timber, the distance of which is regulated by stops. This frame moves across the top face of a knee, which is gibbed to the column with vertical adjustment to any desired height to suit the mortise to be made. The chisel is made square in cross-section, and set into a socket at the front end of the moving frame. An auger is arranged to revolve inside of the chisel, projecting slightly in advance of its cutting edge. It is constantly running, the chisel being passive, except when making the mortise. As the auger works slightly in advance of the chisel, the chips are carried by the twist of the auger into the chisel, escaping through openings in its side.

The chisel bar and auger has a slow, reciprocating motion, and will complete a hole the size of the chisel used An inch chisel will cut an inch square hole, consequently a mortise 1″x4″ requires only four strokes forward to complete it. It has a capacity to work mortises from ⅝″ to 3″ square, and 5″ in depth, and any length desired. The boring spindle is driven by an idler pulley, direct from the countershaft.

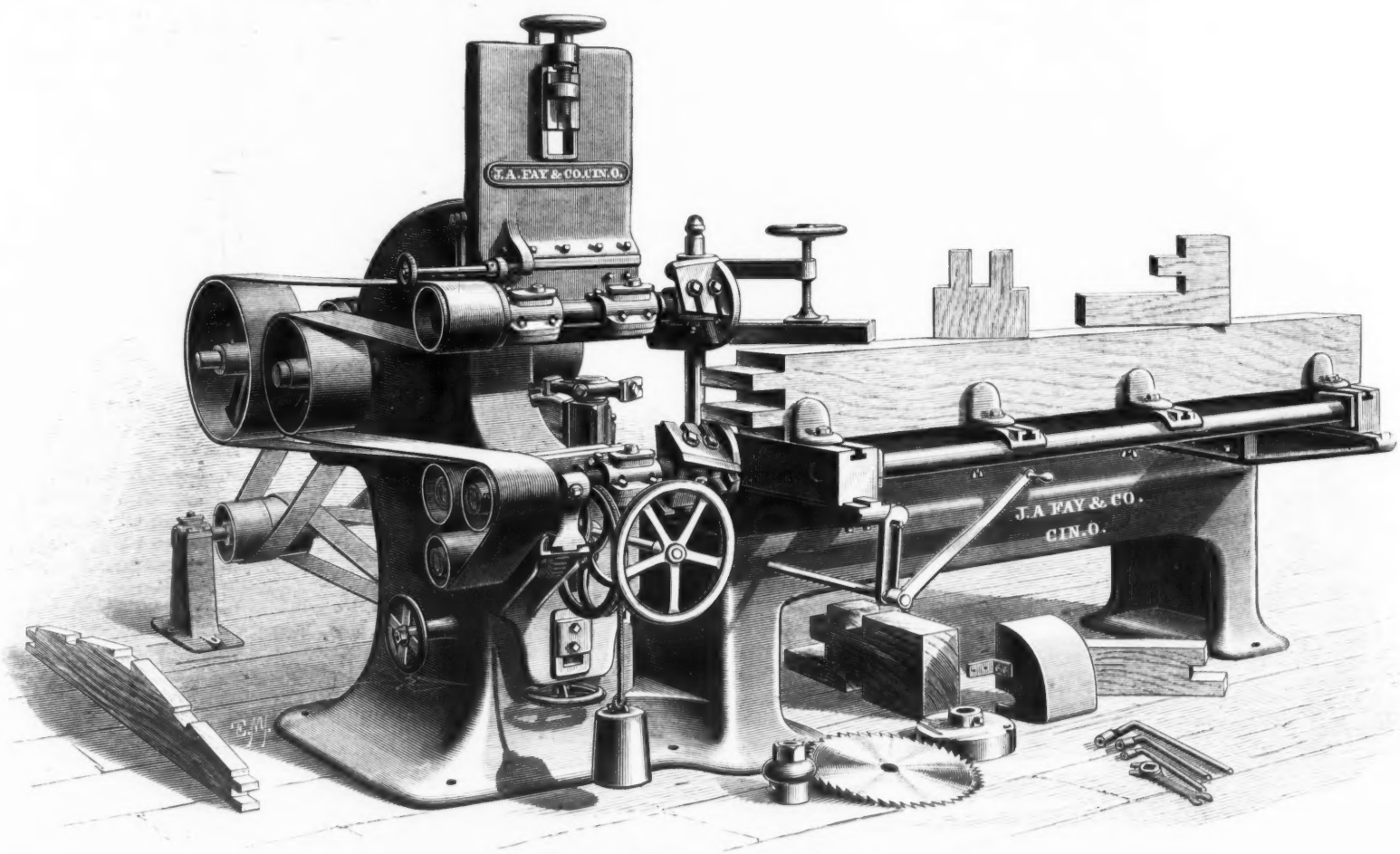
The bed upon which the timber is placed to be mortised is gibbed to a sliding frame, which allows it to be set to any position, with the chisel straight or at an angle. It is adjustable to and from the chisel bar, to suit the size of material, the underside of which always remains at a uniform height. Adjustments are provided for moving the carriage forward, for regulating the depth of the mortise, the position of the chisel from the face of the material, and the adjustment of the chisel bar, controlling the mortises to be made in the timber.

Two treadles are used on the side of the machine, the pressure upon one carrying the chisel bar forward, completing the mortise, while the other will instantly force it back when it is desired to withdraw it from the wood, without allowing it to cut its full depth. Provision is made, by stops, for regulating the length of the stroke, as well as the depth of the mortise.

When once set, and the machine started, it will make any number of mortises without change. Double mortises can be made without moving the position of the timber on the carriage, the adjustment of the chisel mandrel, at the desired point of the second mortise, being all that is necessary. The machine is furnished with ⅝″, ¾″, 1″, 1¼″ and 1½″ chisels and augers.

The tight and loose pulleys are 10″x5½″, and should make 1,000 revolutions per minute.

These machines, together with the one illustrated last week, and others, constituting a complete line of wood-working machinery, occupy floor space 80x38 feet, at Paris. There are 26 machines in the exhibit, in charge of Mr. W H. Doane, president of the company.



UNIVERSAL CAR TENONING MACHINE.

English Railroading.

(Editorial Correspondence.)

As of interest in showing how nearly alike the speed of two steamships of about the same class is, one of the Cunarders left New York just an hour before the City of Berlin, and by securing a pilot at Queenstown, while transferring passengers, thereby avoiding loss of time in doing so later, reached Liverpool fifteen minutes earlier than we did. Of course there was no racing—neither of the boats is a racer—but the fact that they steamed 3,000 miles, out of sight from each other, except at the beginning and end of the voyage, and came out neck and neck, as it were, struck me as quite remarkable.

The passengers of the City of Berlin had an opportunity of seeing the effect of reversing the engine under full speed. The first land seen—if it isn't a bull to call it land—was an immense rock—"Skelligs" Rock, I think, is the name—looming up through the fog at the very point of Ireland. The rock looked to be uncomfortably near, and instantly the bell to reverse came clear and distinct, and the steam reverse did its duty without delay. Directly, however, the bell to go ahead sounded, the ship cleared the rock nicely, and there was no opportunity to see how soon the engine working in back gear would have set the vessel going astern. Some of the overwise ones saw great danger after the rock was passed, but the captain was heard to remark, not a minute before the bell was rung to reverse, that the rock would be sighted within five minutes, and it appeared to me the fog was not so thick that it could not be seen far enough away to avoid any danger. There had been no sun for about two days, yet the time the rock was to show up was down to within five minutes, which appears to be pretty good figuring.

I have traveled a little on English railroads—the longest run was from Liverpool to London, 201 miles—and am unpatriotic enough to say that so far I like it. I know the proper thing for an American to do is to grumble about the way trains are run on English roads. I may see things to complain of before I get through, but just now I must admit that I do not. The cars look wonderfully small and light when compared with American cars, but if this suits the railroad people I do not see why travelers should find fault about it. And, as traveling is done here, I am not so certain the small cars are not best. In stopping at stations the passengers can get out the side doors of the compartments in a fraction of the time required to get out of an American car; so, if the stop is only for two or three minutes, one can stretch his legs on the platform. I have never seen stops made here where a passenger had to travel a half block through the mud to reach the platform. The guards are really obliging, and look out for the comfort of their passengers; and you always find employes at the stations, right along by the door of your compartment, to give you information. I am speaking more particularly of the London & Northwestern road, but assume it applies to others as well.

Cab hire is very cheap in English cities, and nearly every one takes a cab to the station. At the station he is met *at once*, before the cab fairly comes to a standstill, by a railway porter, who takes him and his baggage in charge, shows him where to get his ticket, puts him into his car, marks his baggage—luggage as it is here—and gives him the number of the van it is in, so as to expedite his getting it at his destination. My experience so far is that a passenger with baggage can get a train here on a much smaller margin of time than he can in the United States. The porter expects a small gratuity, and he earns it.

I had reasons for being desirous of getting a certain train from Liverpool to London, but, knowing the distance from the hotel to the station, it seemed impossible to reach it, get a ticket and get baggage all right before train time. I explained the situation to a hotel porter, and about as quickly as you could tell it he had a cab at the door, my baggage down stairs and on the cab, and a word or two from him to the driver made the latter use his persuasive powers over horseflesh in a way that got us speedily to the station. Before I hardly knew it I had my ticket, was in a smoking compartment, and the porter had my baggage marked and had given me the number of the van in which it was placed. There were three men engaged in expediting my exit—the hotel porter, cabby and the railroad porter. They all expected a small tip—cabby for the extra work involved in persuading his horse to greater diligence—but they would have said nothing had they not got it. As I had made the train I wanted against what appeared to be heavy odds, I am bound to say I never used small coin the using of which gave me better satisfaction, or that was better earned by those who received it. We do things in a hurry in the United States, but I could never get a train there under the same circumstances as quickly as I got this. I mention these things because they are all, here, part of railroad travel.

I had read a great deal about the trouble of unchecked baggage, and expected, if the stories of travelers could be relied upon, a good deal of skirmishing and considerable delay in London. But about as soon as I struck the platform a porter was alongside. I told him how my baggage was marked and where I wanted to go; everything looked in a snarl around the luggage van, and I saw the porter merge himself in the crowd, with some misgivings as to when he would get out again. He soon emerged, however, triumphantly; I looked at my watch when the train stopped and again as the cab started; the time had been 15 seconds less than three minutes. An American baggage master, when you could have got to him, would have spent about that time in looking at you if you were trying to get your baggage in less than fifteen minutes after the train arrived. I mention the exact time, as I took considerable pains to note time for a purpose. I had really believed that the American plan expedited getting along with baggage wonderfully, that it was more mechanical, methodical and all that. I have very serious doubts about it now—in fact, I do not believe it at all. The English system requires the services of more men, but everything is done quicker, and, it seems to me, better. Probably, as in many other things, each system is best in its place, but it don't help American railroading to tell stories about what is done elsewhere.

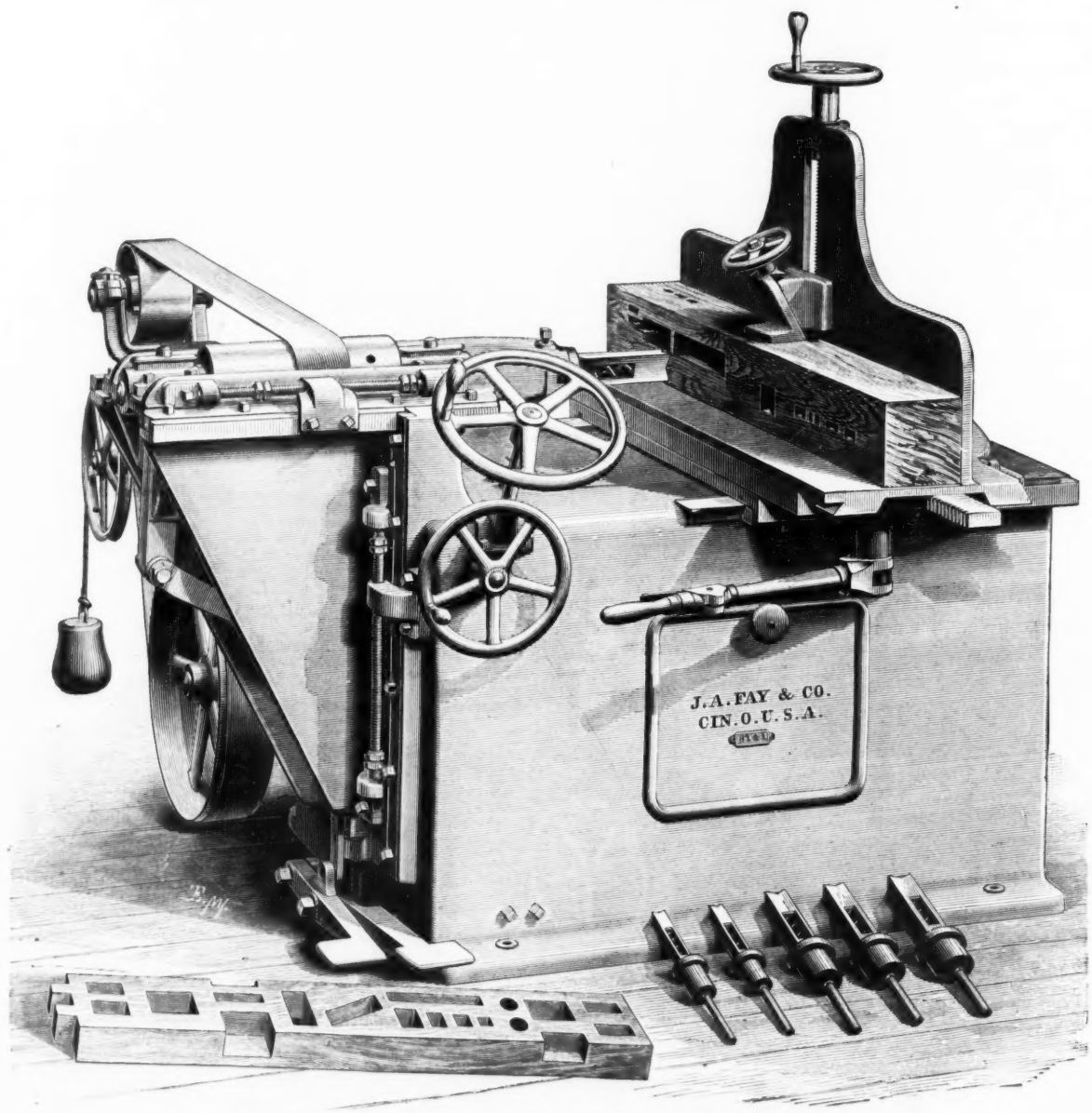
Speaking of cab drivers, they are amongst the most useful members of English society. They know all places; what they don't know about getting you where you want to go is hardly worth the knowing; and when you are in a hurry a few pence extra is a remarkably potent factor. An English gentleman on the steamship told me he paid two dollars and a half to get his trunk and himself to a hotel in New York. He believed the charge exorbitant, and appealed in vain for better terms. A London cabman would get but two shillings—forty-eight cents—for the job. No one without experience would believe the wonderful utility of cab service in London. Anywhere, at any time, day or night, a sharp whistle will bring a cab to your assistance so quickly that you will wonder how it got there or where it came from. Something like the London cab system would work wonders in New York. What is there now is not to be compared with that of an English city of the size of Liverpool, to say nothing of London.

The running time of the train by which I traveled from Liverpool to London is four hours and twenty-five minutes, or a trifle more than forty-five miles per hour. Four stops were made, aggregating twelve minutes from full stop to starting. From Liverpool to Crewe—I do not know the distance, but it is something like fifty minutes' run—the train appeared to move slowly; average time was not made. For a time after leaving Crewe fifty miles an hour was made, with occasional spurts of sixty miles, though these were not plenty. Then nearing London the speed was not so high. We reached London ahead of time, and it appeared as though materially better time could have been made. But the train was not more than half the weight of American trains on roads that will compare somewhat with the London & Northwestern.

I had read that the light English cars were unsteady at fifty to sixty miles per hour, the explanation being that they were not heavy enough to prevent excessive side motion and swaying. I found the car I was in to be quite the reverse of unsteady. There was no shaking up at stopping and starting, and when at speed the side motion was very slight. In getting away from stations, over switches, etc., there was some tendency to unsteadiness—rather more than in the case of a heavy car—but I found quite as little trouble in writing under full speed as in American cars on the best roads.

As far as I have seen, all English passenger trains are light in comparison with American trains, and the roads are straighter and with less grade. In building railroads here, when they come to a hill they go through it, not over or around it. It does not seem possible to make the time on American roads, with the heavy trains, that is made here with the light ones. I mean the time that is made by some of the fastest English trains, or the average time of all trains. English locomotives, with their large driving-wheels, are not fit for train service on American roads, nor are American locomotives fit for service here. Put an English locomotive on an American train, and the important element of piston speed is lacking while getting up to speed from a stop. The engine exerts too little power when running slow. But with an English train the exertion of much less power is required to get the speed up. It makes a difference whether the work in eight cylinders full of steam can be used in going a certain distance, or only those in five or five and a half cylinders full.

With the American engine on the English train there is, at the high speed of English trains, too great piston speed. The distribution of steam is not satisfactory nor economical. When the speed of any engine is so great that the loss in getting steam into and out of the cylinder is excessive, no one would expect to gain much power by increasing the speed



AUTOMATIC CAR MORTISING AND BORING MACHINE.—SEE PAGE 1.

It would be lost in the work of taking care of the steam and in increased friction. Putting out of sight the rather confusing idea of leverage, and coming down to the quantity of steam handled for a given motion ahead of the train, seems to me to make it clear why the English locomotive, with its large wheels, is not suited to get heavy American trains up to speed in reasonable time. Then consider the loss involved in trying to get steam into and out of small ports at too high piston speed, and the loss in friction incident to the more rapid motion of parts under friction, and it seems plain that American express locomotives are not fit for English trains. The systems of train service are quite different in the two countries. In America it is heavy trains, small driving-wheels, and necessarily moderate speed. In England, light trains, large wheels and high speed. Here again it appears that things are best adapted to the different practice of the two countries.

After seeing some hundreds of English locomotives they look better than at first. They have the appearance of being made for business. The little round-topped dome looks strong and substantial, if not ornamental. I have seen some locomotives in which the dome was covered with polished brass, the shape conforming to that of the dome. I must say that I have never seen anything that looked worse. The dome of an English locomotive was never made for ornamental purposes.

Coming up from Liverpool the locomotive of a passenger train going in the same direction kept right abreast of the car I was in for about two miles, so watching her work was as easy as watching the working of a stationary engine. She seemed to me to get right down to business. H.

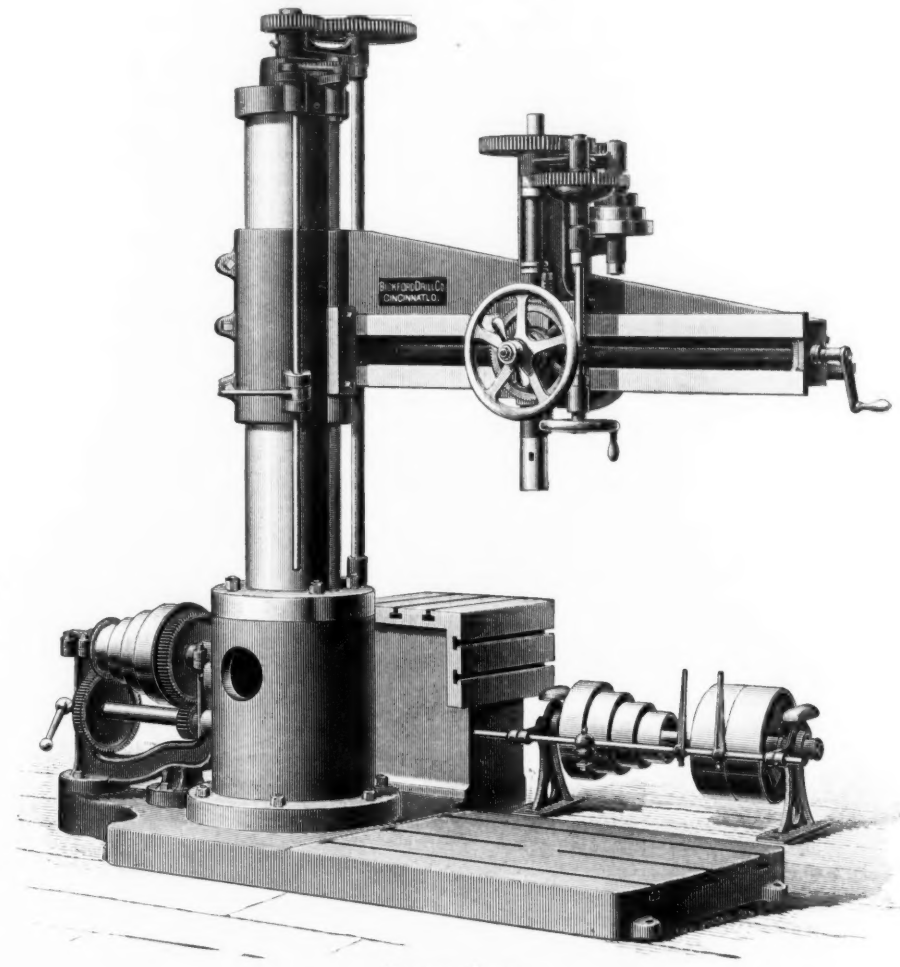
Radial Drill.

We illustrate on this page a new radial drill, brought out by the Bickford Drill Co., Cincinnati, Ohio.

The base plate of this machine is made sufficiently heavy and well ribbed beneath to secure rigidity, and to it is bolted a short column, having the large round base shown. Over the upper portion of this column the main column is fitted, and is held firmly in place by three clamping bolts, which pass through the flange, under which there is an anti-friction bearing, allowing the arm to be swung easily.

The arm is of the box form, raises and lowers by power, and carries the drill spindle head, which in the larger sizes can be turned to any angle, from the vertical down to a horizontal position.

The machines are back-geared, power being transmitted from the cone shaft by means of bevel gears and a vertical shaft up through the center of the column to the top. The smaller elevated table, having T slots on top and at the sides, is furnished with each machine. The spindle has automatic feed and is counterbalanced, provision being made for moving it vertically by hand, either with fast or slow motion.



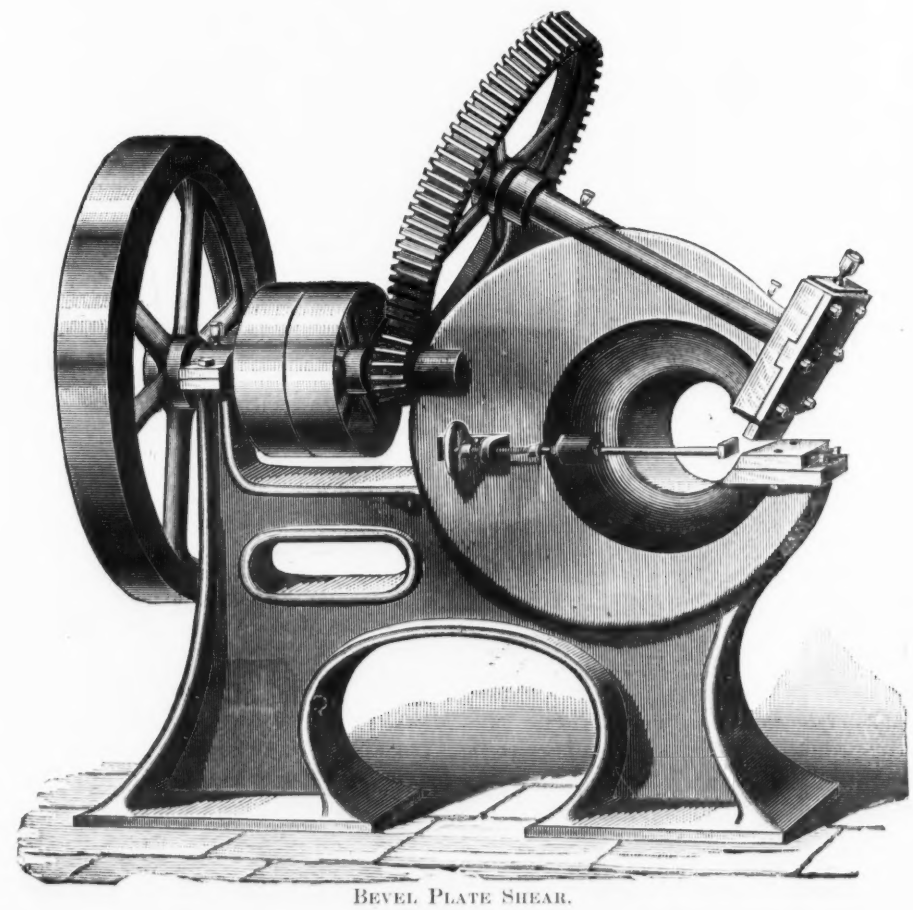
RADIAL DRILL.

The machine is sufficiently rigid and powerful to shear rapidly and smoothly iron or steel plates up to ⅝″ thick, and angle iron up to 8″ wide. The depth of throat is 10″; the front bearing of the main shaft 5½″ diameter, and the crank-pin 3½″ diameter. From 5″ to 6″ can be cut at one stroke. The weight as shown in cut is about 4,500 pounds. Tight and loose pulleys are 16″ diameter, 4½″ face, and should run 175 revolutions per minute.

The American Bevel Plate Shear.

We give with this an illustration of an improved power shear for plate work, made by The American Tool Works, Cleveland, Ohio.

As will be seen, the machine does not differ essentially from other shearing machines, except in the fact that the main shaft is placed at an angle of 30° with the horizontal, and the slide being at right angles to it, plates are sheared at a corresponding angle, and thus have beveled edges. This is effected by an arrangement of bevel gears, which, though not often met with, is entirely practical. The stop gauge is now made somewhat heavier than shown in the engraving, and is adjusted by a hand-wheel.



BEVEL PLATE SHEAR.

"German Copying."

We are in receipt of a communication from a mechanic, now in this country, who states that he worked two years for the firm of Ludw. Loewe & Co., of Berlin, whose catalogue we referred to in our issue of July 4. He states that "they started in originally building sewing machines, but, recognizing the superiority of American machine tools, Messrs. Ludwig Loewe and Barthelmas came to this country to try to arrange for their introduction into Germany. Failing in this, they decided to build them for themselves."

They bought a lot of tools for their own factory in Berlin, and engaged an American mechanic, then employed at Colt's armory, to superintend the building of small tools and fixtures, and are now, our correspondent says, "undoubtedly the leading machine tool builders on the continent of Europe," employing first-class help, and having the best paid shop men in Germany. "Besides their regular line of tools built from American designs, they build a quantity of special machinery of their own design, employing a staff of about twenty designers and draftsmen to do the work." These statements we present, believing it to be no more than rendering justice to Messrs. Ludw. Loewe & Co., and are glad to note the good effects resulting from the adoption of American ideas.

Shop Notes.

BY JARNO.

PULLEY DONE UP IN LEATHER—FOOT-STOCK SPINDLE NOT UNCLAMPED BETWEEN CHANGES.

It is the same man that was running his lathe backwards with the turning tool upside down. Now he is turning the inside of the rim of a light pulley. Upon the outside he has tightly laced a piece of belting that is a little shorter than the circumference of the rim. He did this to prevent chattering. He says that the pulley chattered quite badly before the leather was put on.

To most of us it looks a little odd to see a man do anything up in leather before commencing to turn it. Still, if this conveniently prevents chattering, it may be the "right way." In regard to running a lathe backwards to prevent chattering, Mephit said: "A man should be able to turn smooth, and run the lathe the right way, too." We can easily tell whether a lathe is running forward or backward, but to say that it is not running the right way when it is doing better work running backward, may not be quite accurate.

It has often been said that the difference between success and failure may be made by a little thing Many old stories must be told again. Every week the AMERICAN MACHINIST is read by some young man that has never read it before. A foreman in a tool company in Hartford tells of a little thing that forms one element in his success. When turning pieces that are not heavy and that must be often changed, he instructs the workman, "Keep the foot-stock spindle and its screw well oiled; set up the binding screw enough to bring a medium tension upon the spindle; do not loosen the binding screw in changing from one piece to another." By so doing, he says that the changes are made in less time, and that the work is more accurately sized. In setting up the binding screw there may be enough difference in the pressure upon the spindle between one time and another to make too much variation in the diameter of the turning, because of a variation in the position of the center. Such a refinement may appear over-nice, yet my informant says it is entirely practical. Mephit thinks it a bad practice to move a foot-stock spindle when the binder screw is set up, because this brings undue wear upon both the spindle and its screw. "This idea of wear," says Gascon, "is much a matter of opinion formed about something that we are not accustomed to see. A little thought will show that no moving of the foot-stock spindle that can be made by hand is likely to wear it so much as the live spindle will be worn running by power. Moreover, it sometimes pays to wear out a tool quick by uses not foreseen by the designer. I have for years used a milling machine for a screw planer. I do not now care whether or not it is a good milling machine, so long as it is a good planer."

Our correspondent, Robert E. Masters, sails July 24 on the "City of Rome," for Europe, having been selected by a popular vote of moulders and others interested, to represent the machinery moulders of America in the expedition of American mechanics and tradesmen which is to be sent to the Paris Exposition and some of the manufacturing centers of the old world, for the purpose of gathering information regarding mechanical matters, by Scripp's League of American newspapers. Mr. Masters' selection for this expedition is made the occasion for a very complimentary account of his career, illustrated by a woodcut, in the *Machinery Moulders' Journal* for July, with which journal we join in wishing him a successful and profitable trip.

Practical Drawing.

BY J. G. A. MEYER.

EIGHTY-FIRST PAPER.

591. Now let us consider what the result will be when the cutting plane is parallel to the base of the pyramid.

In elementary geometry it is proved that if a plane intersects two parallel planes, the lines of intersection will be parallel. To illustrate this theorem let us refer to the shaded portion in Fig. 489*a* (last paper). This portion we know to be a frustum of a pyramid, and, according to the definition of a frustum of a pyramid, Art. 583, we know that the upper base $a_3\ d_3$ is parallel to the lower base $a\ d$; let us now consider these bases to be simple planes, and let us also consider the lateral face $a_3\ b_3\ a\ b$ to be a plane; here then we have two parallel planes $a_3\ d_3$ and $a\ d$ intersected by a third plane $a_3\ b_3\ a\ b$; the lines $a_3\ b_3$ and $a\ b$ will be the intersections of these planes, and, according to the theorem just given, the line $a_3\ b_3$ will be parallel to the line $a\ b$; indeed, Fig. 489*a* makes the truth of this theorem very clear, and it may seem unnecessary to state this theorem here, but we shall have to refer to it again when we consider other figures in which the truth of this theorem will not be so apparent; nevertheless it will be applicable, and may remove considerable doubt from our minds.

592. Again, we know that two lines which are parallel in the elevation or vertical projection must also be parallel in the plan or horizontal projection; hence it follows that lines $a_4\ b_4$ and $a_2\ b_2$, Fig 489, which are the horizontal projections of the lines $a_3\ b_3$ and $a\ b$, in Fig. 489*a*, must be parallel. In a similar manner it can be shown that all the other sides of the upper base of a frustum of a pyramid must be parallel to corresponding sides in the base; and furthermore, it must be obvious that the sides of the upper base of a frustum of a *right* pyramid must be (Fig. 489) at equal distances from the vertex v_2.

593. If now we consider $v\ a\ d$, Fig. 489*a*, to be the vertical projection of a pyramid, and Fig. 489 the horizontal projection of the same, and $a_3\ d_3$ a cutting plane parallel to the base $a\ d$, and it is required to determine the section made by the given cutting plane, we can find this section in Fig. 489 in precisely the same manner as we have found the section $a_4\ b_4\ c_4\ f_4$ in Fig. 488. But remembering the theorem just stated, we may save ourselves considerable labor by adopting the following method, and in the meantime obtain greater accuracy.

Through the point a_3 (Fig. 489*a*) draw a vertical line, cutting the diagonal $a_2\ d_2$ (Fig. 489) in the point a_4; through the point a_4 draw a line $a_4\ b_4$ parallel to $a_2\ b_2$. From the the vertex v_2 as a center, and tangent to and line $a_4\ b_4$, describe a circle (not shown), around this circle draw tangents parallel to the sides of the lower base; the polygon thus formed will be the required section.

594. Since the sides of this section are parallel to the horizontal plane of projection, we see the true form and dimensions of this section, and therefore a construction such as is shown in Fig. 488*b* is not necessary.

595. From the foregoing it follows that the section $a_4\ b_4\ c_4\ f_4$, in Fig. 489, is similar to the base $a_2\ b_2\ c_2\ f_2$; that is to say, the sides of the section will have the same proportions as the sides of the base, and the angles formed by the sides in the former will be respectively equal to the angles formed by the sides in the latter.

596. The theorem given in Art. 591, and the remarks in Arts. 592 to 595, are not only applicable to right pyramids, such as we have shown in Figs. 489 and 489*a*, but they are also applicable to any other pyramid through which a plane is passed which is parallel to the base; and we will be correct in saying that, in passing a plane parallel to the base through any pyramid, the section thus obtained will be similar to the base. To illustrate, let $v\ a\ d$, Fig. 491*a*, be the vertical projection of any pyramid—in this case an oblique one—and Fig. 491 the horizontal projection of the same. Let $a_3\ d_3$ be the given cutting plane parallel to the base, then the section $a_4\ b_4\ c_4\ d_4\ e_4\ f_4$ will be similar to the base $a_2\ b_2\ c_2\ d_2\ e_2\ f_2$; the side $a_4\ f_4$ will be parallel to $a_2\ f_2$, $f_4\ e_4$ parallel to $f_2\ e_2$, and so on; also the angles formed by the sides of the section will be respectively equal to angles formed by the sides of the base; in fact, we have precisely the same results as those obtained by passing a plane parallel to the base through a right pyramid, shown in Figs. 489 and 489*a*, with this one exception, in Fig. 489 the sides of the sections are all at equal distances from the sides of the base; and Fig. 491 all the distances between the sides of the sections and the sides of the base are not equal. The whole matter is summed up in a theorem given in elementary geometry, and it is this: Any section of a pyramid made by a plane parallel to its base is a polygon similar to the base

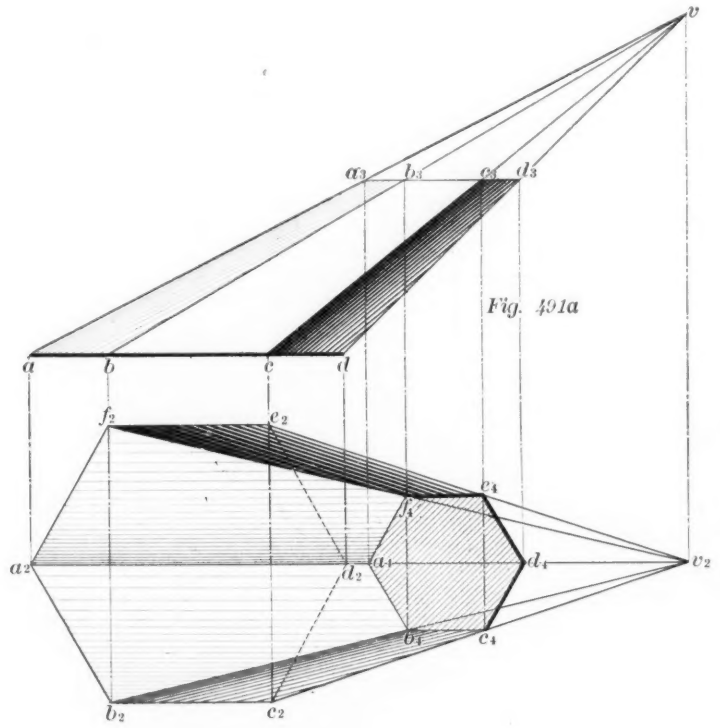


Fig. 491a

Fig. 491

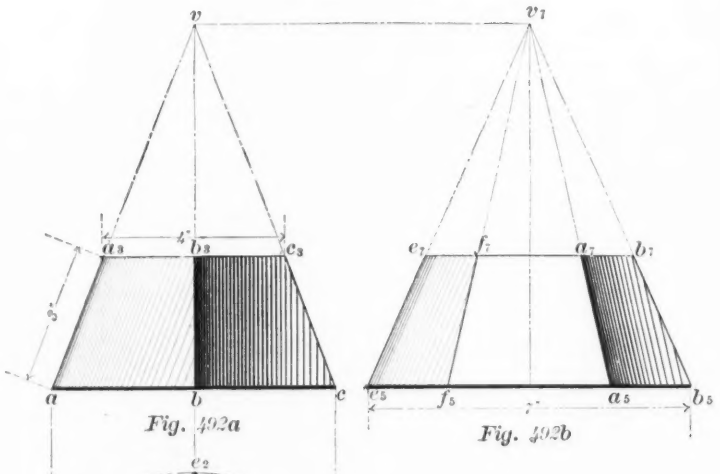


Fig. 492a

Fig. 492b

Fig. 492

597. It will be good practice for the student to draw on a separate piece of paper the vertical and horizontal projection of an oblique pyramid, whose base is a regular polygon of any number of sides; anywhere in the vertical projection draw a line $a_3\ d_3$ parallel to the base, and let this line represent the cutting plane, then find the section in the horizontal projection by the method indicated in Figs. 488 and 488*a*; also find the section by the short method given in Art. 593. Of course, in adopting the short method for finding the section of this pyramid we cannot describe from the vertex v_2 as a center a circle around which the sides of the section are to be drawn, as explained in Art. 593; the center of this circle will be the point in which a vertical line drawn through the middle of the line $a_3\ d_3$ intersects the line $a_2\ v_2$. The sections found by this method and the method similar to that shown in Figs. 488, 488*a*, must be exactly equal to each other, and must also be similar to the base; if such results are not obtained then there is inaccuracy or a mistake somewhere, which must be rectified.

The knowledge of simple geometrical theorems and propositions, which have been proven to be true, will aid us in the solutions of practical problems, and will often save us much labor; in fact, problems which may seem to be intricate to a mechanic will be of the simplest kind when viewed in the light of these theorems; the truth of this statement will become apparent as we proceed.

Problem 90.

598. *To find the vertical and horizontal projections of a given frustum of a right pyramid.*

The object in giving this problem is to apply the theorems previously given, and also recall to mind some of the former problems. With this object in view we shall purposely give such dimensions of the frustum of a right pyramid which may appear to be very inconvenient for the purpose of making a drawing of the same; dimensions given in this manner will not lessen the practical value of the problem, as in practice we have to deal frequently with dimensions which may appear to be somewhat awkward to use in making a drawing of a piece of mechanism; and yet if the elementary principles of drawing have been mastered, dimensions given in this manner will not throw any difficulties in the way in making the drawing, as we shall see in the problem before us.

The distance across corners of the lower base, which is hexagonal, of the given frustum of a right pyramid is 7 inches, as shown in Fig. 492*b*; the distance between the sides of the upper base is 4 inches, as shown in Fig. 492*a*; and the slant height of the frustum is 3 inches; it is required to make an elevation and a plan—vertical and horizontal projection—of the given frustum.

According to the given conditions we may either make an elevation like that shown in Fig. 492*a*, or one like that shown in Fig. 492*b*. If we attempt to make the latter we find that we have not the necessary dimensions given for the upper base; and if we attempt to make an elevation like that shown in 492*a* we find that we have not the necessary dimensions given for the lower base. Here, then, seems to be a difficulty; but if we have mastered the definitions and theorems previously given, we can readily overcome it; in fact, we will find that by commencing in the right way we shall not have any difficulty to overcome. Let us first decide which of the two elevations shown in Figs. 492*a* and 492*b* is best for us to make. In our problem we have the slant height given, and since the lines $a\ a_3$ and $c_3\ c$ in Fig. 492*a* represent the slant height (Art. 585), we shall decide upon making an elevation like the one shown in Fig. 492*a*. Again, since in this figure we require to know the distance from a to c, which has not been given, we are compelled to draw the plan first, such as is shown in Fig. 492.

Now, since we have to deal with a frustum of a right pyramid we know that the lower base is a regular hexagon (Art. 564.) Again, a regular hexagon can always be inscribed in a circle (Art. 191.) Hence, Fig. 492, from any point v_2 as a center, and with a radius of $3\frac{1}{2}$ inches—which is one-half the given distance across corners in the lower base—describe a circle; through the center v_2 draw a vertical line $v\ b_2$, cutting the circle in the points b_2 and e_2; and inscribe a regular hexagon as explained in Art. 191 (Problem 32), taking care that two of the angles formed by the sides of the polygon lie in the line $v\ b_2$.

Now in Art. 596 we have seen that any section of a pyramid made by a plane parallel to its base is a polygon similar to the base; hence the upper base of our frustum must be a regular hexagon. Once more, according to Art. 564 we know that the axis $v\ b$ (Fig. 492*a*) of a right pyramid must be perpendicular to the base $a\ c$, and must also pass through the center of the base, from which we conclude that the axis must also pass through the center of the section $a_3\ c_3$, which in our problem is the upper base of the frustum.

Therefore in Fig. 492 the point v_2 will also be the center of the upper base; hence from the point v_2, and with a radius of 2 inches, describe a circle, and around this circle draw the hexagon $a_4\ b_4\ d_4\ e_4$. Join the points a_3 and a_4; b_3. b_4; c_2, c_4 and so on, by straight lines, and thus complete the plan of the given frustum of the right pyramid.

Fig. 492*a*; anywhere above Fig. 492 draw a line $a\ c$ perpendicular to $v\ b_2$. Through the points a_3 and c_3 (Fig. 492) draw vertical lines cutting $a\ c$ in the points a and c; the line $a\ c$ is the vertical projection of the lower base, and gives us the missing dimension. From the point a as a center, and with a radius equal to 3 inches, that is, the slant height, describe a short arc; through a_4 (Fig. 492) draw a vertical line cutting the short arc in the point a_3; through the point a_3 draw

a horizontal line; through c_4 (Fig. 492) draw a vertical line cutting $a_3\ c_3$ in the point c_3; join the points c_3, c, and a, a_3 by straight lines, also draw the vertical $b\ b_3$ which, of course, must pass through the centers of the lines $a\ c$ and $a_3\ c_3$; this completes the elevation of the given frustum.

Here, then, we see that, although the distance from a to c was not given, we did not have any difficulty or extra labor in finding it; the whole imaginary difficulty disappeared in applying the elementary principles previously given, and by commencing the right way, namely, in drawing the plan first, and this certainly does not involve any extra labor in making the two views of the given frustum of the right pyramid.

Directions.—In the space marked (Problem 90), draw the vertical and horizontal projections of a frustum of a right pyramid whose dimensions have been given in the foregoing problem. Use 3-inch scale.

In working drawings, one elevation of this frustum is sufficient; hence if Fig. 492*a* has been drawn, then Fig. 492*b* will not be required. But for the sake of practice, and for the sake of testing the accuracy of workmanship, it is advisable to draw both elevations of the frustum. These should be drawn without finding the points v and v_7 in Figs. 492*a* and 492*b*. After the elevations have been completed, then prolong the lines $a\ a_3$, $b\ b_3$, $c\ c_3$; if all these lines meet in one point v, we may conclude, until another test has been made, that so far our construction is correct. The next test will be to prolong the lines $e_5\ e_7$, $f_5\ f_7$, $a_5\ a_7$ and $b_5\ b_7$ (Fig. 492*b*); if all these lines meet in one point v_7, and the points v and v_7 lie in one horizontal line, then the whole construction is correct. If one of the points v and v_7 is higher than the other, or, in other words, if the altitude of the pyramid differs in Figs. 492*a* and 492*b*, then the bases in one of the figures, or both figures, have not been correctly drawn. The mistake should be found and corrected.

Details of Sweet's 16-Inch Engine Lathe.

BY PROF. C. I. KING.

(*Concluded.*)

The novel features of the foot-stock are principally in its general form, in the device for swinging it out of the true plane, and in the compression sleeve. The center in Fig. 34 is the same as that in the head-stock, and is interchangeable. In drilling for the screw and center, stock is left as shown at n, for a nut for the center to screw into. A steel sleeve S is left fitted to the spindle, and the casting is bored large enough to receive it. S is nine inches long, and is conical at each end. These cones fit counter parts in the casting at $T\ T$. The sleeve is split in four parts at the ends, to allow contraction of the diameter, and is caused to travel endwise by the nut N, and handle H, Fig. 34, also shown in transverse section $A\ B$ at N, Fig. 35. The thread in this nut has a pitch of one-half inch, and is divided into eight parts. A small rotatory movement of the nut thus produces a comparatively large end movement. The compression occurring at points so far apart, gives an exceptionally rigid support, and it is the best device for the purpose that I have seen.

The eccentric device for clamping to the bed of the lathe is similar to many others in use, except that the shaft is placed lengthwise of rather than across the bed. The foot-stock rests on a plate P, Figs. 34 and 35, which is fitted to the bed. The nut N', which receives the screw s' for the transverse movement, terminates on its under side in a cylinder which fits in a hole h in the plate P, Fig. 34. By withdrawing the bar B, which extends across the plate, and has half its thickness in the plate and foot-stock, the foot-stock may be turned around through several degrees of arc. The clamping plate C needs to be removed in this operation. This plate also serves to bring the spindle to its true plane in resetting, by causing pressure on the side of the bar B. The clamping block C', Fig. 36, is shown in section at C', Fig. 34. The block has a recess on its under side for the nut, and is carried back and forth with plate P by four projecting parts $p\ p$, which prevent it from catching during end movements of the foot-stock.

In Fig. 38, a longitudinal section of the countershaft is presented. The cone C and sleeve S are one casting, the fast and loose pulleys being fitted to it. The shaft S' is fastened in the hangers by set screws, and does not turn. Holes for oil reservoirs are drilled into each end of this shaft and screws are fitted to them at the end, and common oil holes are then drilled through the hanger hub into the reservoir, and a set of distributing holes are drilled in the reservoir which lead out through the sleeve to the loose pulley on one end, and to the sleeve only at the other end. This distributes the oil thoroughly, and is not likely to fail in its feeding.

The bar B, for shifting the belt on the cone, is shown in dotted lines, where it passes under the cones.

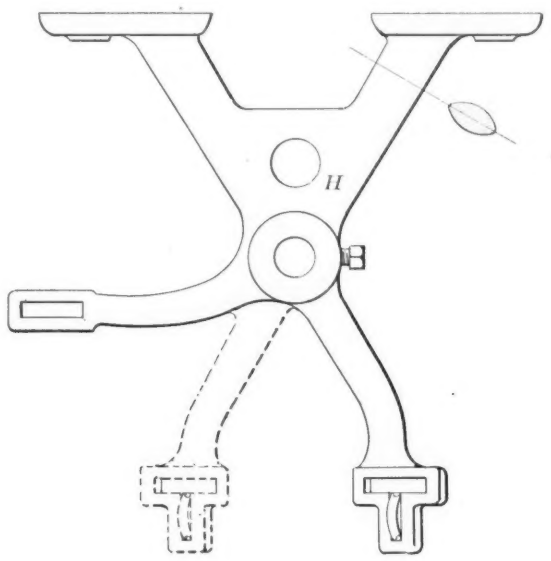


Fig. 39

Fig. 40

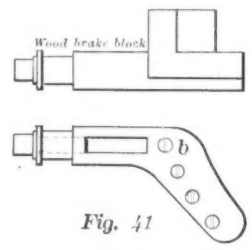


Fig. 41

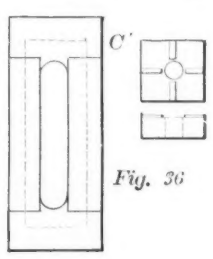


Fig. 36

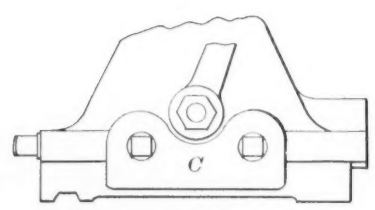


Fig. 37

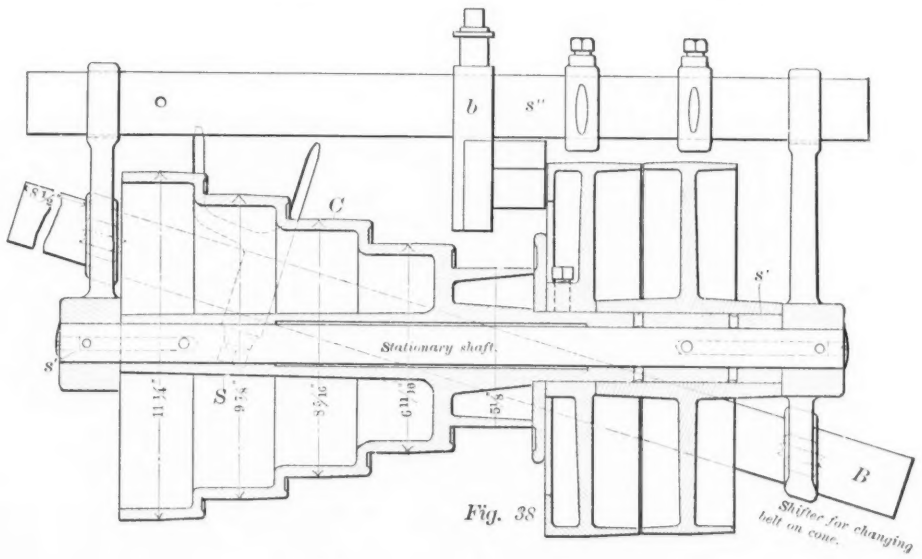


Fig. 38

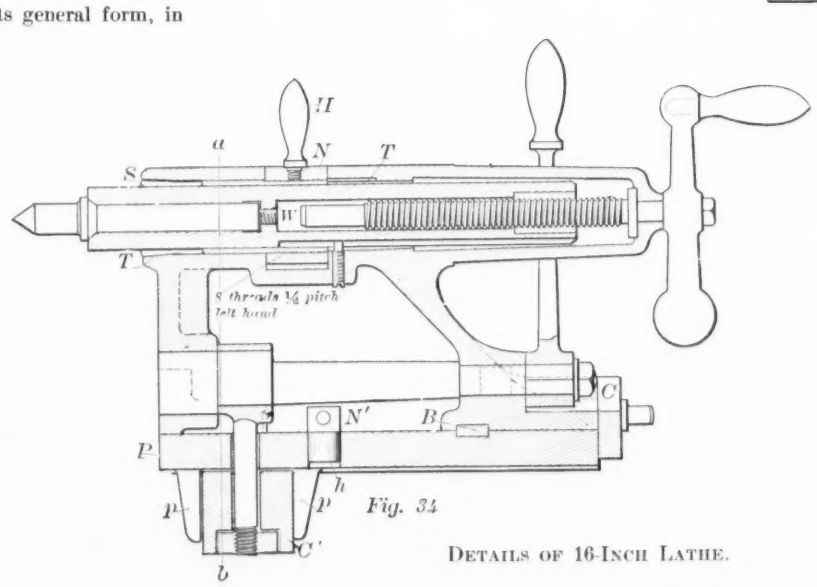


Fig. 34

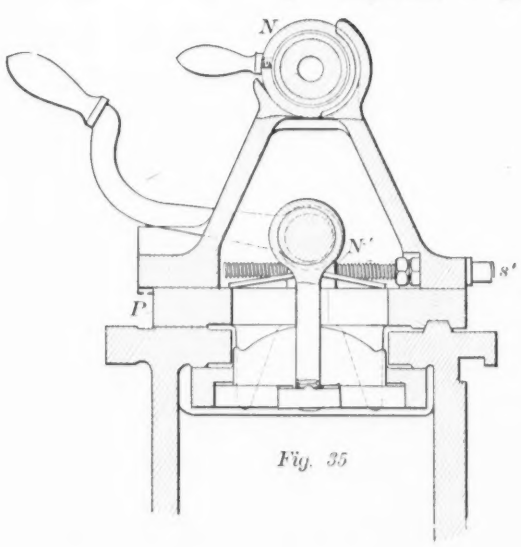


Fig. 35

DETAILS OF 16-INCH LATHE.

The hanger H is represented in side elevation at Fig. 39, and in plan at Fig. 40.

A brake block b, for stopping the lathe, is shown on the main shifter bar s'', and in side elevation at b, Fig. 41.

In using the lathe, these points of difference between it and the ordinary lathe present themselves: It is driven by a single belt and when the belt is thrown off, the brake is put on the counter to stop the lathe by the single motion of the shipping lever. Friction clutches never stick, and when the operator attempts to stop the lathe it stops, and does not run backwards.

When the operator wishes to change the belt on the upper cone he does not have to try four or five times to throw it and then go for a pole. When he wishes to throw in the back gear he only has one motion to make. When he wishes to bore a taper hole any given taper to the foot it is only necessary to set the head-stock to the mark. When he wishes to operate upon a piece less than 4″ thick and up to 24″ in diameter it will swing in the gap of the lathe, and that without any change in the lathe either before or after. When he wishes to set for any pitch screw he has no gears to select or put on. The lathe cuts 24 standard threads from 3½ to 28, and feeds for turning ⅛ as fast as when screw cutting, so that twenty four fine threads can be cut. In screw cutting, the slide may be run back and forth by reversing the screw, or the nut thrown out, the slide run back by hand, and the nut thrown in, without stopping the lathe at all.

The forward feed and cross feed are so proportioned that, if both are thrown in at the same time, the cut will be at the angle of 60°, and so the lathe centers turned correctly. If a lot of pieces of unequal length are to be turned taper, the head-stock set at the proper taper, the foot-stock brought in line with it, and the work done the same as straight work, and that, too, without moving the foot-stock center out of truth. The foot-stock can be removed from the lathe without disturbing any part of it.

Literary Notes.

IRON VIADUCTS FOR HIGHWAYS. By J. A. L. WADDELL, Consulting Bridge Engineer, Kansas City, Mo.

The above is the title of a pamphlet written in the interests of both scientific engineering and true economy of construction. The author points to the importance of giving the subject of viaduct designing more attention than it has hitherto received, and says:

"Bridge designing in the true sense of the word has become a specialty, but, unfortunately, most of the highway bridges and viaducts built in this country show indisputable evidence that they are the work of inexperienced hands instead of that of experts. The reasons for this are not difficult to discover. In the first place, the preliminary study of the crossing and the lay-out of spans are made either by the city engineer or more probably by one of his assistants. Now, no matter how good a city engineer a man may be, unless he be thoroughly posted in the designing of iron-work, and unless he has made a special study of viaducts, the lay-out which he will determine will be both faulty and far from economical. Next, the method of letting the contract is often a cause of very unsatisfactory results. Too often the work is advertised and thrown open to general competition upon very meager data, viz.: span lengths, widths of roadway, and sidewalks, live load, and what is termed 'factor of safety.' Every highway bridge concern in the country is at

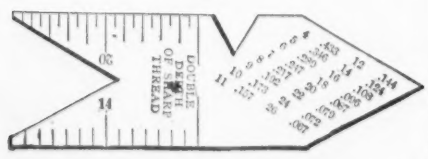
liberty to bid in such a case, and, as the contract generally goes to the lowest bidder, the chances are in favor of the work being taken by incompetent and irresponsible parties. These parties usually entrust the detailing of the structure to draftsmen who receive salaries not exceeding one hundred dollars per month. It is preposterous to imagine that such men are capable of successfully grappling with and solving some of the most intricate problems that occur in engineering practice. The complete designing of a viaduct upon a grade (as is generally the case), crossing railroad tracks at various angles, most spans being on a skew, and seldom two skews being alike, the railroad tracks having different elevations, with the distance from floor surface to clearance line below to be kept at a minimum, and the matter of longitudinal and lateral expansion and contraction to be properly provided for, involves the employment of as much care, patience, technical training, judgment, ability and experience, as will almost any problem to be met with in engineering practice."

The foregoing statements, we believe, point out clearly the reasons for the failure of some of the structures erected, and the consequent disappointments, and loss of capital invested. That there are in this country many highway bridges and viaducts defective in design is unfortunately too true; but to say that *most* of these structures show indisputable evidence that they are the work of inexperienced hands, is a statement somewhat severe, particularly when it is remembered that even experts will not agree on all the details of construction. The failure of some structures erected at the expense of the taxpayer may often be traced to the interference of political influence rather than to the incompetency of the city engineer.

The author points out faulty designs, and gives valuable hints relating to proper constructions of viaducts; on the whole the pamphlet is well worthy of a careful perusal and earnest consideration. He concludes with instructions relating to the manner in which the contract for a viaduct should be let, in order that the parties who furnish the money may obtain a structure which will answer all reasonable requirements at a minimum cost, and says:

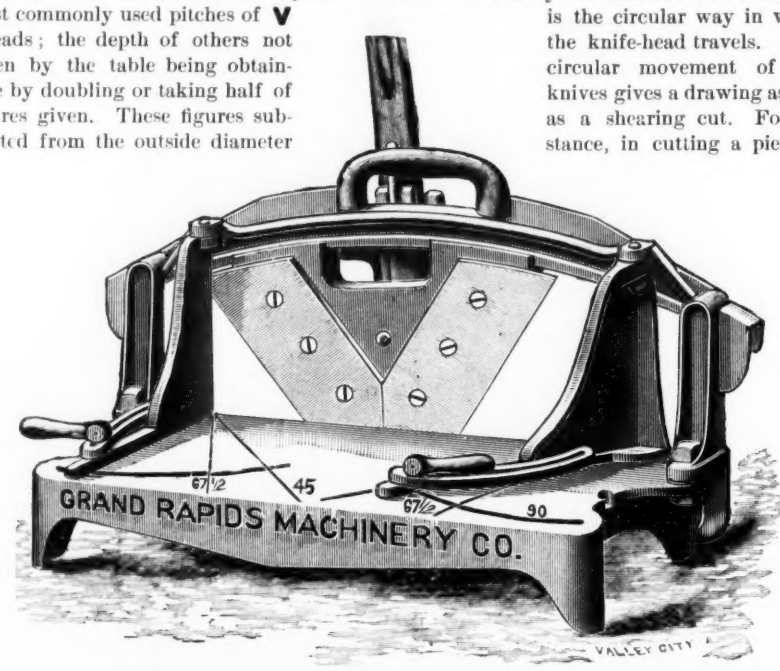
"The first step to take is to call in consultation a specialist of acknowledged ability, so as to determine what are the necessities of the case, and what kind of structure it is advisable to build; the next, if time presses, as it generally does in this country, is to have this specialist to prepare a general plan and elevation of the proposed structure, together with diagrams of stresses and sections, a sufficient number of sketches of details to illustrate the general character of the design, an approximate estimate of the quantities of the various materials and complete specifications, then call for bids upon schedule prices, limiting the shipping weights of metal to a variation of two per cent. from those called for by the strain sheets and detail drawings, allowing only reputable builders to bid, and awarding the contract to the bidder whose tender, everything considered, appears to be most favorable to the parties who pay for the work. The next step is to have the specialist prepare detail drawings so complete, that all the dimensions of every portion of the structure will be accurately determined, said drawings to comply in general with the specifications and the preliminary drawings; the next step is to engage a competent and trustworthy inspector to follow the iron through mills and shops, to see that the quality of material and workmanship be as good as specified; the next is to engage a competent and reliable superintendent to look after the erection, and see that all the work of both substructure and superstructure be done in strict accordance with the specifications, both inspector and superintendent reporting to the specialist who prepared the designs; and the final step is to have the latter examine the completed structure, so as to officially accept it before the contractor be paid for the work."

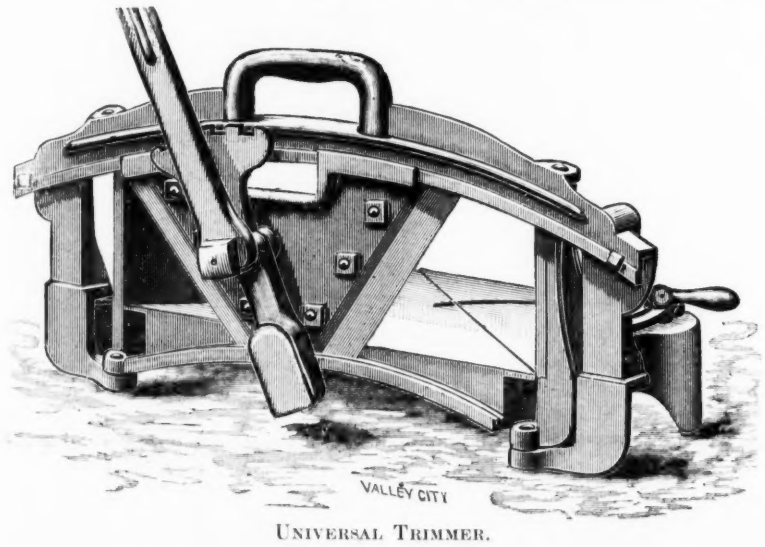
This we believe to be sound advice, and should be followed.



Improved Center Gauge.

The accompanying illustration shows an improvement which has been made upon the familiar center gauge so long used by machinists and tool makers who care for accuracy in the angle of lathe centers, and in the grinding and setting of threading tools. The angles and the general form, of course remain the same as before, the improvement consisting in the addition of a table giving, in thousandths of an inch, twice the depth of the most commonly used pitches of V threads; the depth of others not given by the table being obtainable by doubling or taking half of figures given. These figures subtracted from the outside diameter of a screw of course give the diameter at bottom of thread and the proper size of tap drill. This is an improvement which we think will be appreciated by all who use the center gauge. Darling, Brown & Sharpe, Providence, R. I., are the makers.





UNIVERSAL TRIMMER.

making core prints, fitting joints, etc., largely dispensing with the use of the butt-plane, chisel, saw, miter-box, square, etc.

Quite a number of new improvements have been introduced, and it differs essentially from the old styles. One of the new features is the circular way in which the knife-head travels. This circular movement of the knives gives a drawing as well as a shearing cut. For instance, in cutting a piece of ¾-inch stock 4 inches wide, 1¾ inches of the knife edge is used, and, as can readily be seen, the wear is distributed on the knife, and it keeps sharp much longer than if it moved in a straight way. Also much less power is required than if it moved in a straight way.

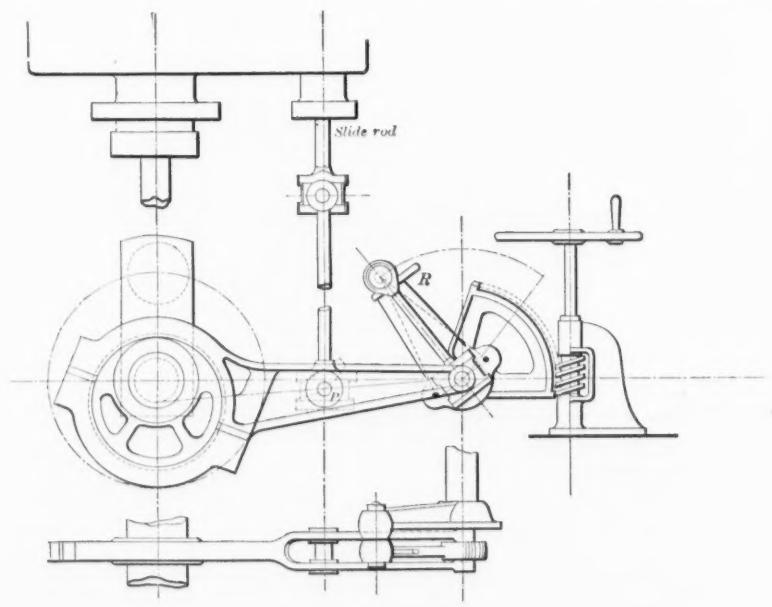


Fig. 103
MARSHALL'S VALVE GEAR.

Universal Trimmer.

The accompanying cuts represent a new style of universal trimmer, lately designed by Mr. Jos. W. Oliver, of the Grand Rapids Machinery Co., of Grand Rapids, Mich. The machines are to be used on the pattern makers' bench, to aid in doing such work as putting draft on patterns, fitting segments, making core prints, fitting joints, etc., largely dispensing with the use of the butt-plane, chisel, saw, miter-box, square, etc.

The adjustable handle is a new feature, which enables the operator to use it as best suits his convenience. The device by which the knife head is moved is simply a lever fulcrumed at its lower extremity, and provided with a covered slot, which works upon a roller fastened to the bed of the machine.

The adjustable gauges are worked on pivots, and lie close to the knives, thereby preventing the back edge of the wood from breaking down. Care has been exercised to make the machine heavy and rigid, with ample bearing for all wearing surfaces.

The bed of machine is graduated so that the gauges can be set square or at any desired angle.

Marshall's Valve Gear.

One of our correspondents asks for an illustration and description of the Marshall's valve gear used on marine engines. Our limited space in the question and answer columns does not permit us to give it there, and we therefore give below a description, together with a drawing of it, taken from the "Marine Steam Engine" by K. Sennett. "This arrangement of slide-valve gear, which has been fitted to a large number of marine engines, is illustrated in the accompanying figure. In this system only one eccentric is used, the end of the eccentric rod being attached to a rod hung from a pin on the reversing shaft lever *R*, by which it is constrained to move in an arc of a circle inclined to the center line. To an intermediate point *P*, in the eccentric rod, a connecting link is attached, which communicates the necessary motion to the slide-valve rod. By adjusting the position of the reverse lever *R*, any desired degree of expansion can be obtained or the engines reversed as required. In this system there are few working parts, and distribution of steam both for full power and for expansive working is satisfactory."

LETTERS FROM PRACTICAL MEN.

The Eiffel Tower vs. Gravity.

Editor American Machinist:

I would like you to throw a little light on the first paragraph of the clipping I enclose, and which I cut out of a daily paper.

Though the author speaks like one having authority, it would require a large grain of salt to make me swallow the statement made, until the "why" and "wherefore" are explained.

Do you know how it could be "lifted by four men of average strength," or, more remarkable still, how six thousand four hundred tons can be made to press with less weight on the foundation than a man sitting in an arm-chair, and such being the case, why they want a foundation at all? X. Y.

[We do not print the clipping referred to, for the reason that we have already done so in our issue of May 30, in which it is commented upon by a correspondent. It is scarcely necessary to say that it refers to the Eiffel Tower at Paris, and is an item which is making the rounds of the newspspers, and will probably continue to do so, notwithstanding its absurdity ought to be at once apparent to a child.

There are under the tower some machines, constructed upon the principle of the hydraulic press, by means of which one or more of the corners or legs upon which it rests can be raised or lowered to distribute the weight evenly, and keep the tower in proper position. The levers of these presses can easily be worked by one man, and, of course, could be made to be worked by a child just as easily. It has been inferred from this that it pressed upon the foundation with less weight than that of a man, and, in order to account for that, the cantilever principle was brought in. The extent to which the item is being copied is an excellent indication of the prevailing ignorance regarding the simplest physical laws, and explains why people are so easily humbugged by any new and startling scheme for overturning the laws of nature.]

Prof. Sweet's Lathe.

Editor American Machinist:

Mr. Joseph Harrop's criticism on the sixteen-inch lathe, in the AMERICAN MACHINIST of June 20th, is correct as regards the center rest, or at least to a certain extent. It is not so good in many places as the old sort, but in a few cases it is much better. As regards the foot stock leg, it intentionally performs no

duty except to support the weight, and, as it is about twice as strong as the generality of supports placed at that end of lathes of this size, or as it will sustain a breaking load of about 300 tons, and has not much over a half ton to carry, it ought to do. It is not intended to resist the twisting strain due to the cut—for the reason that it is believed if it had the power to offer any aid whatever in this way, it would also have the power to twist the bed, if rested upon an uneven foundation. The intention was to make the bed able to attend to its own business; yet, had it to be done over, I should adopt the box form, which is infinitely better. And in this connection I wish to add that, were I to again wrestle with the problem, I would wholly change the lead screw system for screw cutting. That is, adopt a plan once explained in the AMERICAN MACHINIST—use a short screw 8″ or 10″ long, with a nut of the same length, the screw to be adjustable at any point along a splined rod. This some one will find out is the only possible way to maintain true pitches for every-day work, and even this will require that there be a club suspended over every lathe, imbued with a spirit of chastisement—self-operating whenever the latheman uses the device wrong.

As there has appeared in the AMERICAN MACHINIST, and other journals, illustrations of lathes from which some might think features in this have been copied (such as that of a pedestal full width of the headstock at one end, and a single leg at the other) a feature of which there are a number of examples in the Paris Exposition—I wish to say that so much as there is specially different in this lathe from the ordinary kind grew out of a series of short papers read before our Mechanic Arts Students at Cornell, and afterwards published in the *Polytechnic Review*—in which every part of a lathe was treated by itself, and the argument weighed as to why any particular form ought to be better than all other forms. From this train of argument the drawings from which the most of your cuts were produced were made in 1878 or '79 without any great expectation of their being executed. If there is any merit in the various devices which tool builders can be induced to imitate, the college machine shop at Madison will have been of that much use at least. Unfortunately, what I have long considered the gem of my contrivance, shown in Fig. 18, page 2, of the June 20th number of the AMERICAN MACHINIST, is shown on too small a scale to be readily understood, and the word *rims*, instead of *pins*, in the description, adds to the confusion.

JOHN E. SWEET.

[There were a number of things to be considered in deciding what scale to adopt for the detail drawings of Prof. Sweet's lathe, and chiefly on account of our limited space and the large number of drawings required, we felt compelled to make them as small as possible consistent with clearness; and, even though the scale adopted was rather small for some parts, we thought it better to adhere to the same scale throughout, to avoid confusion. All except the part referred to by Prof. Sweet seems to be sufficiently well shown, and we publish herewith the figure alluded to, just twice as large as before. By referring to the description in issue of June 20 it will readily be understood, and its ingenuity must, we think, be greatly admired.]

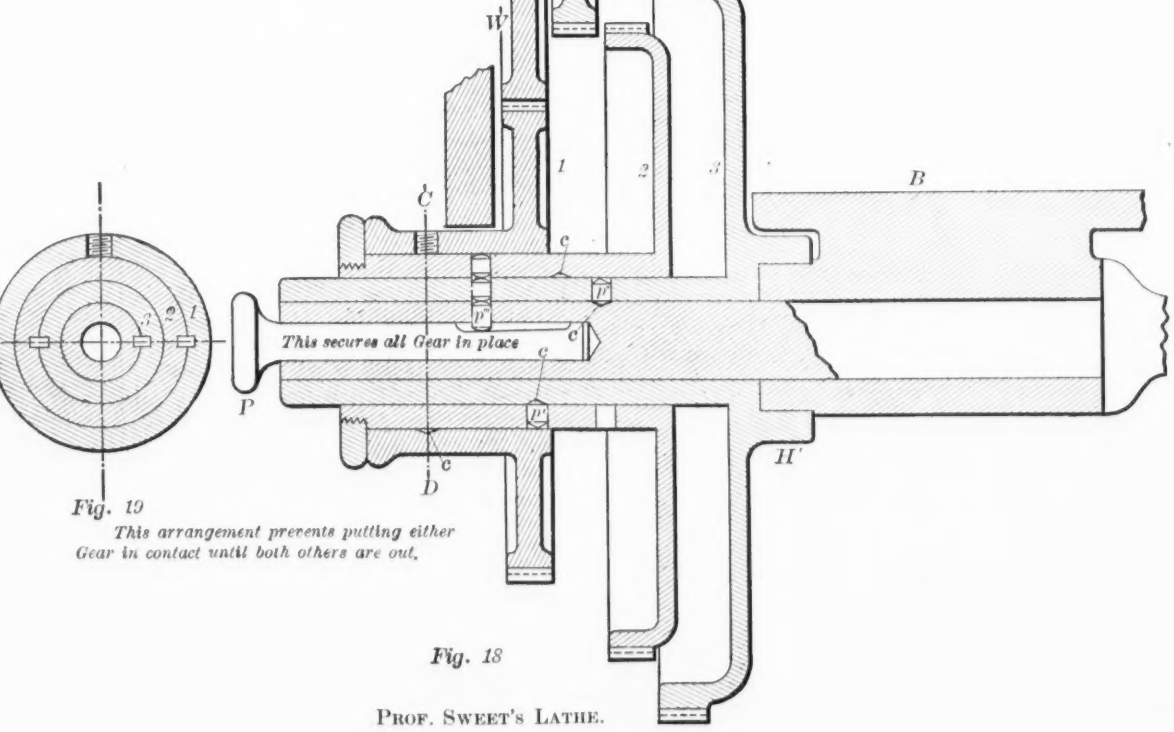


Fig. 19

This arrangement prevents putting either Gear in contact until both others are out.

Fig. 18

PROF. SWEET'S LATHE.

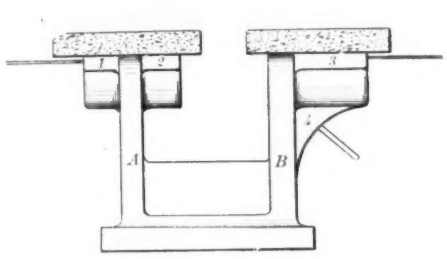


Fig. 1

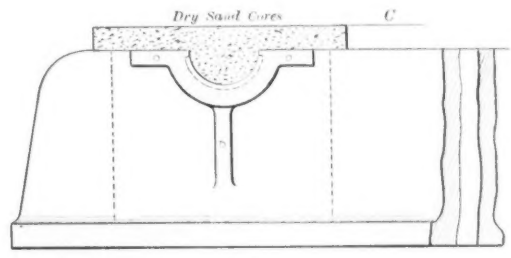
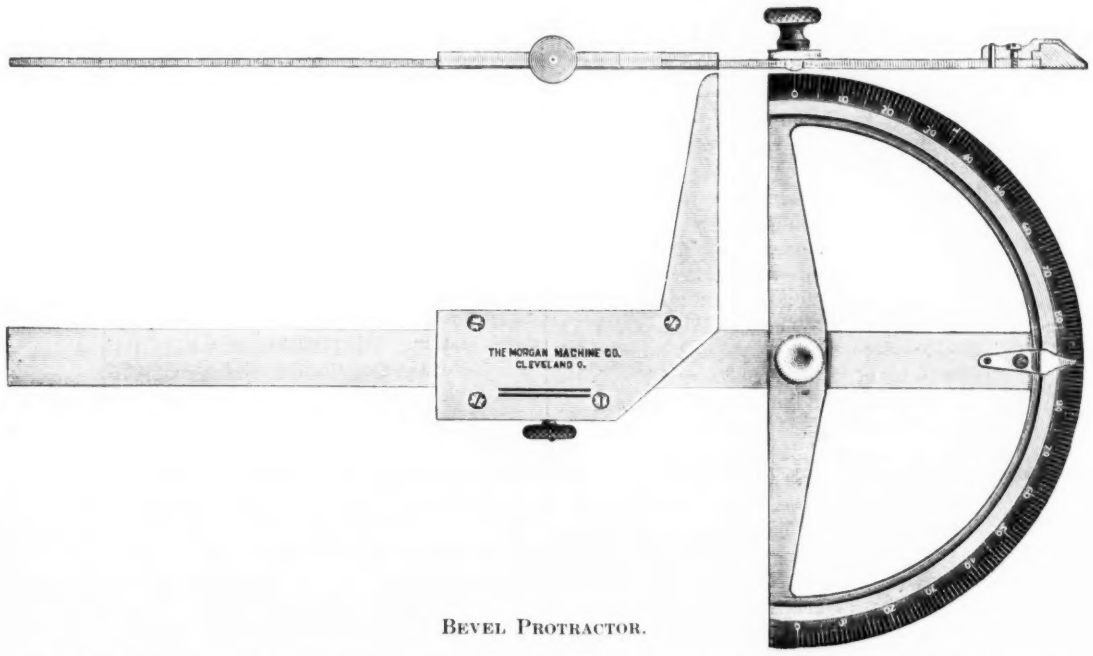


Fig 2

SOMETHING FOR PATTERN MAKERS.

New Bevel Protractor.

We present with this an engraving showing a new bevel protractor, which, besides having an improved construction for the graduated semicircle and pointer, as shown, has, fitted to the blade, a sliding jaw or arm, which is attached and clamped in the same manner as on a slide gauge. This jaw being at right angles to the blade, and in the same plane as the swiveling head, it may be used for gauging the angles of lathe and planer tools, and at the same time can be so set on the blade as to gauge the thickness or size of the tool. All who have had experience with protractors will perceive that, for use in the shop, this feature adds very much to their range of usefulness and convenience. At the same time the jaw can, of course, be readily slipped off when it is desired to use the protractor without it. The makers are the Morgan Machine Co., Cleveland, Ohio.



BEVEL PROTRACTOR.

Something for Pattern Makers.

From the fact that there are so many different ways in pattern making and moulding of doing the same kind of a job, arises a great deal of discussion at times in the pattern shop and foundry, and whenever it is carried on intelligently by men who understand their business, good is sure to result, and the chances are that the best way will be arrived at. On the other hand, there are those who are so eager to advance their own ideas, and have them carried out, that they are unwilling to consider those of others—such an individual is not likely to be very profitable to any concern, for he thinks more of airing his own ideas than of arriving at any results that might be of practical value.

Sometimes, after consulting over a piece of work, a very simple method is arrived at—so simple that we wonder afterward why we did not think of it before. The part of a frame shown in Figs. 1 and 2 is one of those jobs that at first looks a little troublesome for moulding, and yet, upon examination, the trouble vanishes. Figs. 1 and 2 are views showing part of a frame with two boxes cast on the sides. The shape of this frame was such as to necessitate casting the boxes down; it will be seen that there is not enough room to draw in the boxes, the sides *A* and *B* not being thick enough to allow it. This difficulty may be overcome by making the pattern as shown. Make the boxes loose, and locate them on the sides of pattern with loose dowel pins that can be pulled out while ramming up; two cores are made and dried for the boxes, and rammed up with the pattern to *C*, after which the cores are taken out, and the sides of boxes 1, 2, 3, and the bracket 4 are drawn out; replace the cores, and cover over with sand, finish ramming up and roll over flask. There are other ways of making this pattern, as I have hinted; a core print might have been put on the pattern, as shown by dotted lines, and a core-box made with the box pattern in the core box, but it was thought that the above way of doing it was cleaner—this plan is adopted on many jobs where there is not room enough to draw in the loose pieces.

"Be sure you are right, and then go ahead," is an old saying that needs reiterating in the pattern shop, because that is the birthplace of mistakes; and in saying this I do not intend any reflection on the pattern maker, but rather the reverse. I think the responsibility that rests upon the pattern department, as to whether work turns out right, is equal to that of the drawing room; for while the draftsman is responsible for the design, upon the pattern maker rests a large proportion of the responsibility of executing that design. The liability to mistakes is reduced considerably when the machinist takes hold where the pattern maker and moulder have left off; the machinist's part is no doubt the most important as to the workmanship and right working of machinery—he can make it good, bad or indifferent; but mistakes in measurement he is not so liable to as the pattern maker, because the machinist has the casting, and is given the drawing of it, with instructions to finish to drawing.

When a pattern maker is given a drawing he has to imagine the casting before him, and build something that will produce it; it may be called a pattern, but often it is really not a pattern of what is wanted, because of the complexity of the casting; it is sometimes all core-boxes and no pattern, and here is where the responsibility comes in, and will, I think, explain why the pattern shop is the birthplace of mistakes.

Of course, mistakes ought not to occur; but as long as pattern makers are fallible, like other folks, they will occur sometimes, though the utmost precaution may be taken. I am always suspicious of the man that never makes mistakes; he is not to be trusted. It has not been my intention here to defend those careless pattern makers who are constantly making blunders, but to show that, from the nature of the trade of machinery pattern making, there is more danger of errors being made in that branch of machinery building than others, and I do think that the careful, industrious workman who seldom makes an error is worthy of consideration when he does happen to be caught—for such a man usually feels bad enough over his mistakes, without having any one try to make him feel worse. P. S. DINGEY.

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☞ Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.

☞ We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.

☞ We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.

☞ Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.

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NEW YORK, JULY 18, 1889.

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Laziness.

A writer in the AMERICAN MACHINIST once spoke of mental laziness as something quite distinct from that kind of laziness that prompted men to do as little work with their hands as will enable them, in shop talk, to keep their job. The expression seemed very apt at the time, but the drift of events since then leads to the serious questioning of whether there is such distinction. If there is none in fact, it ought not to stand in imagination, because it may do harm. In fact, the idea which many men appear to have, that they can be lazy in using their brains, and the contrary in using their muscles, has probably already done a good deal of harm. We believe that a man who is mentally lazy is also physically lazy; in other words, that, while laziness may find stronger expression in some directions than it does in others, still there is no proper use for the qualifying adjective.

There is no intention of following this with a homily on the subject indicated by the title, but it is a fact that there is a disinclination for brain work on the part of young mechanics in this country, and it is having a serious effect on the standing of American workmen. The young mechanic who tries to get along with as little knowledge of mechanics as his grandfather possessed, is reasonably certain to have a harder time getting a living than his progenitor had, and the prospects for rising in the world of his vocation are not worth considering. The men who use their brains will be the ones to receive advancement—receive it as a reward of industry, and in no sense as a favor.

A man who is too lazy to think about his work, and to study to the end of knowing something of the principles underlying the art, not only will not get any higher in the scale of workmen, but he is too lazy to do his work properly if there is opportunity to the contrary. He is the man who will be left behind in the race all the way through.

At the present time it is much the custom to start evening schools for apprentices and mechanics, and the fact that only a small percentage of those who begin in these schools remain longer than a few weeks, is discouraging to those who spend time and money to get them going. If the future of the two classes—those who desert the school and those who remain—is watched, much may be learned. We will not say that all who remain will eventually find their way to the head of great manufacturing establishments, but they are in the way of doing so, and are literally certain of finding themselves rewarded for their industry. There is not opportunity for all to become generals, but there are required, in mechanical pursuits, many lesser officials, and there is always room for the best privates.

The other class—those who lack the energy to persevere in the school—will be equally lazy in the shop; that is, they will be as lazy as they dare be. They are those who never see anything but dollars and cents in their work, and go through the world bemoaning their fate.

The reference to the evening school is typical only. Such schools are undoubtedly valuable auxiliaries, but by no means a necessity to those who are determined to advance. The apprentice or journeyman mechanic who sees the necessity for knowing something beyond his daily work routine can get along in the path without the school if the school is beyond his reach. He can find his opportunity in the mechanical literature of the day, and in cultivating the habits of thought and observation in relation to his daily work and surroundings. It is said of Kossuth, the great Hungarian patriot, who afterwards captivated the English-speaking world with his almost matchless oratory, that he learned the English language from the Bible and Shakespeare while in captivity. What a lesson for those who "lack the opportunity."

We have already alluded to the fact that engineer Bourke, of the "Calliope," had been promoted for his bravery during the storm in the harbor of Apia. It now appears from the report of Passed Assistant Engineer Harris Webster, who was in charge of the engines of the U. S. vessel "Vandalia" at the time of her loss by the same storm, that every man in the engineers' department did all that his duty demanded in the most heroic manner, sticking to his post until the last minute, and the ship had struck, when the engines were stopped without confusion as though the vessel had come to anchor, when all hands came on deck by order of the captain.

The whole affair at Apia has brought out prominently the fact that there are very important duties to be performed below deck on board a steam vessel—duties which at times require of those who must perform them the utmost bravery and coolness in the presence of imminent danger—and danger made all the more appalling from the fact that it cannot be seen or accurately estimated by them.

It is gratifying to reflect that, though not rewarded by the saving of their vessel, as was the case with the Englishmen, our own men were equally brave, and therefore equally deserving of success in their struggle with the furious elements.

Death by Electricity.

The various electrical journals—and many of the daily papers—continue to discuss with much apparent earnestness the question of execution of criminals by electricity—a discussion which has apparently been stimulated by the efforts of counsel to save the life of a murderer condemned to death, on the plea that execution by electricity, as called for by his sentence, would constitute cruel and unusual punishment within the meaning of the Constitution, which prohibits such punishments.

The lawyers in arguing the matter are, of course, not very particular to confine themselves strictly to facts regarding death by electricity, and the daily papers, and even some of the technical journals, seem to attach as much weight to what is said by them in their arguments before the court as if it were said by a competent electrician or physiologist declaring his honest and unbiased opinion.

But the theme most dwelt upon by our electrical contemporaries is the uncertainty of electricity as a death-dealing agent, and, in their zeal to defend it from the charge of being dangerous to life, they almost make it appear that it is only by taking almost infinite pains, and having everything in the most favorable condition for it, that electricity can be made dangerous at all, and that the means whereby it can be made even reasonably certain to produce death have not yet been discovered. More weight would probably attach to such statements if the same journals did not have so much to say about the "prostitution of the noble science to an ignoble purpose," the "abasement of the high and lofty science," etc., which plainly show that there is, among those specially interested in electricity, opposition to its use for such a purpose, based upon purely sentimental motives.

We hope our electrical friends will pardon us when we observe that this sentiment seems somewhat morbid, and that there is little hope of convincing people that electricity cannot be made certainly fatal when so many instantaneous deaths are constantly occurring from it. And may we not also venture to suggest to our electrical friends that personal abuse of an expert electrician, who happens to differ from them in opinion on this matter, will in no wise strengthen their case, but rather weaken it.

Judging from the facility with which electric currents kill innocent people who happen to come in contact with them, we should say that a person specially prepared to receive it, and having every condition made favorable for the passage of the current directly through the principal nerve centers, would be instantly and painlessly killed. And since this is what is proposed to be done by the authorities we think it will, if tried, be successful, and that the degradation, prostitution and debasement of the noble science so much dwelt upon will be imperceptible to the ordinary mortal, and result in no injury whatever to electricity, either as a science or as a business. While we are not specially desirous that murderers should be executed by electricity, and, in fact, have no special choice as to the manner of their taking off, we do think that almost anything is preferable to the so-called hanging, which is not hanging, but a brutal jerking of the neck for the purpose of dislocating it, which sometimes fails, and at other times jerks the head from the body. Machinists make the dynamos and engines which generate electricity. We venture that none of them will be found objecting to their use for merciful executions, though we humbly submit that they have as good reason for doing so as the electricians have, and that the science of engine and machine construction is to the full as useful and noble as the science of electricity.

The doings of the white lead trust are attracting some attention just now. It controls 90 to 95 per cent. of the productive capacity of the industry, and seems in a very prosperous condition. The owner of some of the stock of this trust, in a conversation with the writer the other day, said that for a time after its formation there was some doubt as to the outcome, and he had feared that the trust stock, which he had taken in exchange for his interest in his own particular factory, would greatly depreciate; but that now the trust certificates were "booming." Some interesting information was given regarding the methods of the trust, and the greater economy of manufacturing and doing business under its control. Most of the traveling men connected with the business had been dispensed with, since it made no difference what brand of lead a customer wanted, and there was no longer any competition between the various factories. Many of the factories had been closed, but still, consumers who preferred the particular brands formerly made by these closed factories were supplied with them, by the simple expedient of keeping large "blank stocks," which means kegs of lead without brands or any other means by which an outsider could tell where their contents were manufactured. These kegs are then branded according to the demand for the various brands, so that a customer who thinks no other brand but "Ulster" will answer his purpose is accommodated so far as the *brand* is concerned, but gets precisely the same lead, made in the same factory by the same process, as though he had bought the "Union" brand.

QUESTIONS AND ANSWERS

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(287) A. M., New York, asks: What is a "miner's inch"? *A.*—A miner's inch of water is approximately equal to a supply of 12 U. S. gallons per minute.

(288) O. M. B. & Co., ———, ask: Will you please tell us which will give the best work in grinding hard castings, such as plowshares and mouldboards? *A.*—We think you will do better with emery wheels.

(289) C. S., Cincinnati, Ohio, asks: What does the sign (π) used in mathematical formulas denote? *A.*—It generally denotes the ratio of the diameter to the circumference of a circle, and always stands for the number 3.1416. Thus, for instance, in the formula $2\pi r$ = circumference of a circle, read $2 \times 3.1416 \times$ radius = circumference of a circle.

(290) J. L. J., Saginaw, Mich., writes: Enclosed find full size diagram of valve and seat; also card taken from a 20x30 inch slide valve engine which has given considerable trouble. I have the opinion of nearly all the experts here, but I cannot find any that agree with me. The engine uses all the steam that four boilers, 66 inches × 16 feet, can make. Steam ports are 1 3-16x14 inches; exhaust port, 2⅜x14 inches; travel of valve, 3½ inches; lap, ⅞ inch; lead, 1-16 inch. My opinion is that the ports are small. I propose to give ⅞ inch in-

side lap, ⅞ inch outside lap, and 4 inch travel of valve, thereby obtaining the same power with less steam. *A.*—We should not hesitate to give 1⅛ inch outside lap, but not more than 1-16 inside lap; travel of valve, 4¾ inches. These changes will promote the economy in steam, but will not give an ideal card, as the ports are too small for the speed of engine; also, the required power of the engine does not admit of the proper degree of expansion, and therefore a greater amount of steam will be used than in a correct designed engine. We should advise, if the design of the engine will admit it, to make the exhaust cavity of the valve at least 1 inch higher than shown in your sketch.

(291) E. F. B., Buffalo, N. Y., asks: How can I describe an involute tooth? *A.*—We will first consider the method for describing the involute without any reference to the gearing. The involute is a name given to the curve which is generated by a point in a straight line rolling along a fixed circle; or we may say the involute is formed by the end of a string which is unwound from a cylinder and kept taut; consequently the string as it is unwound will always lie in the direction of a tangent to the cylinder. To describe the involute of any given circle (Fig. 1) say for example 3 inches diameter, we proceed as follows: Take any point *A* on its circumference, and through this point draw a diameter *A B*, and from the *B* draw a tangent *B b* to the circle, or, in other words, through *B* draw a line *B b* perpendicular to the diameter *A B*. Make this line *B b* equal in length to half the circumference of the circle, that is, $\frac{3 \times 3.1416}{2} = 4.7124$. Divide the line *B b* and the semi-circumference into the same number of equal parts, say six. From each point of division, 1, 2, 3, etc., on the circumference, draw lines to the center *C* of the circle. Then draw 1 a perpendicular to *C* 1; 2 a_2 perpendicular to *C* 2; and so on; in short, through the points of divisions 1, 2, 3, etc., draw tangents to the circle. Make 1 a equal to $b\,b_1$; 2 a_2 equal to $b\,b_2$; 3 a_3 equal to $b\,b_3$, and so on. Join the points A, a_1, a_2, a_3, etc., by a curve; this curve will be the required involute. In order to show the manner of constructing teeth of the involute system, we will take the following example: Let it be required to construct involute teeth for a pair of spur wheels; each wheel is to have 34 teeth; pitch is to be ¾ of an inch. The diameter of the pitch circles will be $\frac{34 \times .75}{3.1416} = 8\frac{1}{8}$ inches very nearly. Draw the straight line *A D* in Fig. 2; from any point *A* (on this line) as a center, and with a radius equal to $\frac{8\frac{1}{8}}{2} = 4$ 1-16 inches, draw the pitch circle *P*, also from the point *D* as a center, and with a radius of 4 1-16 inches, draw the pitch circle P_2; these pitch circles must of course touch each other in the point *e* on the line *A D*. Through the point *e* draw a line *H H* perpendicular to *A D*; also through the point *e* draw a line *T T*, making an angle of 15°

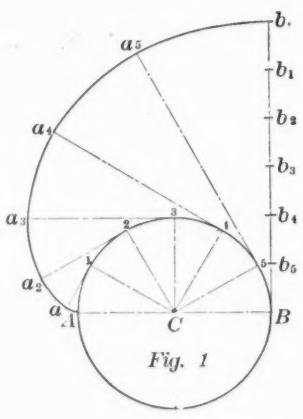

Fig. 1

with the line *H H*. Through the center *A* draw a line *A s* perpendicular to *T T*, cutting the latter in the point *s*. From the point *A* as a center, and with a radius equal to *A s*, draw a circle *B*; this circle is called the base circle; in a similar manner draw the base circle B_2. From the point *e* set off on the pitch circles the pitch of the teeth; and with the usual proportions set off on the pitch circles the thickness of the teeth; also, on the line *A D* set off the required amount of the teeth which is to be outside the pitch circles; and on the same line set off the required amount of the teeth which is to be inside of the pitch circles. From the center *D* describe a circle *A C*, passing through the top of the teeth; this circle is called the addendum circle; through the bottom of the teeth, and from the same center *D* draw a circle *R C*; this circle is called the root circle. The addendum circle *A C* cuts the line of contact *T T* in the point *m*; from *A* as a center, and with a radius equal to *A m*, draw the flank circle *F* of the upper wheel; this circle gives the lowest points of contact on the flanks of the teeth, and should always lie a little outside of the base circle *B*. From *A* draw the addendum and root circles of the upper wheel; the latter addendum circle will cut the line *T T* in the point *n*; from *D* as a center, and a radius *D n* describe the flank circle F_2. At any convenient point *u* on the base circle *B* draw an involute $u\,u_2$; the method of drawing this involute is of course the same as given in Fig. 1, but it must be remembered that, instead of having a circle 3 inches in diameter to deal with, we have now the base circle on which the involute is to be constructed. Now either cut a template to the curve $u\,u_2$, or find an approximate arc of a circle to the curve; then, with the arc thus obtained, describe the part of each tooth between the addendum and flank circles. The remaining portions of the teeth between the flank circle and the bottom or root circle are drawn tangent to the involute. To draw the tangent proceed as follows: From the center *A* with a radius *A t* equal *m s*, that is, the difference between *e s* and *e m*, describe a circle, and draw the line *t m* tangent to this circle, and to the involute at the point *m*; all the teeth are completed in a similar manner. Of course, the two tangent lines of each tooth should not cross each other. The bottom corners of the teeth should be rounded as shown. The length of the path of contact is *m n*, being a part of the line *T T*, which is cut off by the addendum circles of the respective wheels. These intersections show where the contact begins and ends.

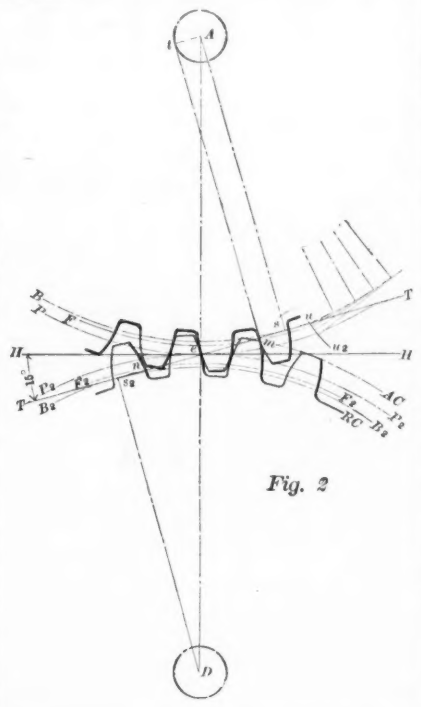

Fig. 2

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Iron Planers from 16″ to 36″ wide by any length. H. C. Pease & Co., Worcester, Mass.

Boiler Catechism; 800 prac. questions practically answered, $2.00. Pract'l Pub. Co., 21 Park Row, N. Y.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See June 20, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

"Useful Hints on Steam." By E. E. Roberts—2nd Edition—96 page book—mailed upon receipt of 20 cents. W. Blitz, 107 Liberty st., N. Y.

The best emery wheel made is the "Norwich." For particulars send to Montgomery & Co., 105 Fulton st., New York.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

The hook on steam engines is being supplanted by the Dill disconnecting device, made by the T. C. Dill Machine Company, 726 Girard ave., Phila., Pa.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches, working drawings for the transmission of power by steam, water, air and electricity.

Contract work of all kinds executed promptly and on reasonable terms. Parties wishing grey iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N. Y.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages illustrated, 12mo., cloth, $2. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y.

Patterson, Jordan & Gottfried, 146-150 Centre st., N. Y. Metals, Machinery, Hardware, Tools and Supplies for Machinists, Mills, Engineers, Brass Goods Mfrs., Factories, etc. An extensive assortment of Bolts, Screws, Wire, Taps, Drills, etc., carried in stock.

Patent or shop rights for sale, for perforating iron or steel plates for steam boilers, bridge work, iron or steel ship work, marine boiler heads, equal to drilled work and fifteen times quicker. Samples can be seen and circulars obtained from R. E. Dietz, 60 Laight st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including May 23, 1889 issue, 77 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 92 articles have thus far appeared up to and including the May 30, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

Water-works are to be built at Bryan, Texas.

J. H. Woody will start a machine shop at Asheville, N. C.

The Alabama Midland R. R. Co. will locate shops at Troy, Ala.

Water-works and sewerage system will be put in at Eureka Springs, Ark.

A planing mill will be erected at Lexington, Tenn., by Pearson, Hutton & Co.

The mills of the Pleasant River Granite Co., of Addison, Me., are to be enlarged.

Engineers are at work on extensions of the Alabama, Georgia & Florida Railroad.

E. B. Borden is president of the newly organized Charleston Rice Mills at Goldsboro, N. C.

Bonds have been issued for the enlargement of the Adams Cotton Mills, at Montgomery, Ala.

An iron foundry and plow factory are being built at Hughes Springs, Texas, by Keasler & Vicker.

It is reported that the Mann-Boudoir Car Co. will build an addition to their machine shops at Ludlow, Ky.

A cotton factory is to be established at Mobile, Ala., on the co-operative plan. The total stock will be $100,000.

Elkirk White, W. S. Bonnard and H. E. Ernhart are the incorporators of the White & Bonnard Milling Co., at Mattoon, Ill.

The Layman Safety Car Coupler Co., of Little Rock, Ark., are contemplating the erection of works at Memphis, Tenn.

The Fish Manufacturing Company, of Columbus, Ohio, intend to rebuild their buildings, which were recently destroyed by fire.

A cotton mill is to be built at Halifax C. H., Va., by the Banister Mill and Improvement Co. It will have about 5,000 spindles and 100 looms.

An extension of the Louisville & Nashville Railroad is said to be in contemplation, to run from Bangor to Blountville, Ala., a distance of twelve miles.

The La Valle (Wis.) Roller Mill has been incorporated with $25,000 capital, the incorporators being H. M. Johnston, W. H. Bonesteel and Samuel Andrews.

A committee of council at Fort Worth, Texas, has reported in favor of adding an 8,000,000 gallon pump, and extending the mains of the water works system.

A hardware factory will be established at Anniston, Ala., by George Geer and E. M. Lewis. The machinery will be put into the nail and machine works of the latter.

The contract has been let for the grading of eleven miles of the Midland, Highland & Lake Butler Railroad, which is to run from Middleburg to Lake Butler, Fla., a distance of twenty miles.

One of the largest flour mills in Minneapolis is said to be using considerable water on its wheat before grinding, and it is also reported almost cooks it by the use of steam heaters, the results being very satisfactory.

A proposition for water-works recently submitted to the people of Georgetown, Ky., for endorsement, was almost unanimously accepted, and work will be commenced at once.

It is announced that the death of Mr. Lucius W. Pond will not interrupt the continuance of the business of which he was the head. The company will continue the business as before.

A narrow gauge railroad is to be built to run from Aspen, Colorado, to Ashcroft, a distance of twenty miles. It will be called the Aspen Mountain Railway, and it is expected that work will begin some time this month.

The Carson City mint, which has been idle since 1885, is about to resume active operations in accordance with a recent decision of the Treasury Department. It is expected to begin active operations about July 1, with a capacity of $200,000 per month.

Huston & Sons, of Coatsville, Pa., will build a new mill entirely of iron, and fitted up with the most improved modern machinery. Several sets of rolls, 10 feet long, 36 inches diameter, and a large steam crane for conveying iron piles to and from the furnaces will be put in.

L. P. Valiquet and F. G. Spencer have associated themselves together under the name of the Manhattan Tool Co., their place of business being at 142 Fulton street, New York city. They build fine tools and intricate machinery for watchmakers, opticians, and machinists, and do model and experimental work.

The Tradesman says: "The Roebling Works, of Trenton, recently shipped a wire cable for the Denver City Cable Railway Co. The weight of the cable is 100,970 pounds; it is a trifle over seven miles in length, and is said to be the largest single wire cable ever shipped by the Roebling Works. The car on which the cable was shipped is constructed of steel, with 16 wheels, and weighs 54,400 pounds, the total weight of the car and its load being 155,370 pounds."

Woodruff King, of Camden, N. J., has devised and copyrighted a time-slip for use in shops, which he calls the "Short Way" time-keeper. The system consists of small slips, containing blank spaces to be filled out when one is given to a workman at the commencement of work or a job. There are also figures for time which are to be marked by pencil or punched out. It is somewhat similar to that which we illustrated in our issue of Feb. 28, but the arrangement of the slip is different.

Circuit Court at Madison, Wis., has decided that the law is constitutional which was enacted by the Wisconsin legislature last winter for the purpose of reclaiming many thousands of acres of land by requiring mill dams at Madison and Stoughton, which cause a heavy backwater in the chain of four lakes, to be lowered. This is a preliminary skirmish case, to be fought desperately through the courts, between farmers on one side and millowners and wealthy citizens of Madison on the other.—*Northwestern Miller.*

The management of the Huntingham colliery of the Lehigh & Wilkesbarre Coal Company has discharged all the Polanders and Hungarians employed in the mine, to the number of nearly 300. A notice was also posted that in future none but English-speaking and experienced men would be employed. This is the first case of this kind on record, the employment of foreigners who will work for less wages than the English-speaking men being generally encouraged. Ignorance and recklessness of the foreigners is believed to be the cause of this step, two accidents, each causing the death of three men, having happened in the last two weeks.—*Industrial World.*

A successful experiment, valuable to the mining community, was made last week at the laboratory of the Joseph Dixon Crucible Co., of Jersey City, N. J. A piece of iron was used, ten inches long, two inches wide, and one-sixteenth of an inch thick. One-half of its surface was painted with Dixon's silica graphite paint, the other half left unpainted. It was then suspended for several days in a bath of dilute sulphuric acid. The acid bath was much stronger than any sulphur water met with in mining. Taking the iron from the bath, the unpainted part was found eaten off to about one-half its original bulk. The painted part did not sustain even the slightest blemish. This proves conclusively the ability of this paint to withstand sulphuric acid, and demonstrates its usefulness, particularly in mining, where iron piping is laid in sulphur water.

An important system of railroads is projected in Georgia, in connection with the Chattanooga, Rome & Columbus, the Columbus Southern, and other roads. It is proposed to build a road from Dawson to Quincy, thus completing the connection from Chattanooga by a north and south line from Chattanooga to Quincy when the C. R. & C. is completed to Columbus. The *Atlanta Constitution* says: "It is proposed to unite these roads in one system from Chattanooga to Quincy, and there to make close traffic arrangements with the Florida Railway & Navigation Company. It is proposed to extend the Chattanooga, Rome & Columbus by way of Warm Springs to Cordele, and on to Savannah. It is said that this will make a shorter route from Chattanooga to Savannah than any existing line. Other extensions are proposed. It is thought that arrangements will be made with the Georgia Midland for an entrance into Columbus. The intersection of that road by the Chattanooga, Rome & Columbus will be at Warm Springs. How the road will come into Atlanta is not stated. It has been the plan heretofore to build a branch of the Chattanooga, Rome & Columbus from Cedartown direct to Atlanta, and that entrance will probably be adopted."

Machinists' Supplies and Iron.

NEW YORK, July 13th, 1889.

Iron—American Pig.—Trade has been moderate, though there seems little or no pressure to sell and prices are firmly maintained. We quote, Standard Northern brands, No. 1 X Foundry, $16.50 to $17.50; No. 2, $15.50 to $16. Southern brands, No. 1, $15.50 to $16.50; No. 2, $15.25 to $15 75; Grey Forge, $14.50 to $15.25.

Scotch Pig.—We quote Coltness, $21.50 to $21.75; Gartsherrie, $20; Summerlee, $21 to $21.50; Eglinton, $19 to $19.25; Dalmellington, $19.75 to $20; Clyde and Langloan, $20.50.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—By first-class machinist, situation as foreman of general machine shop. J. A., AM. MACH.

Wanted—2 or 3 first-class machinists; no others need apply; references required. Address Munson Bros., Utica, N. Y.

Mech. draftsman (23), graduated at German tech. college, wants position; salary $10 weekly. Address F. C., 208 S. 8th st., Philadelphia, Pa.

Wanted—Position by a brass moulder; one accustomed to mach. and jobbing work; can give first-class ref. Box 113, AMERICAN MACHINIST.

Wanted—A first-class sheet-brass worker; one accustomed to stamping and spinning lamp work; good pay to right man. Metal Worker, AM. MACH.

Machinist Wanted.—One first-class job hand; also, one blacksmith and machinist on tools and jobbing; must be good workmen. J. H. Wells, Tampa, Fla.

Wanted—One experienced mechanical engineer and draftsman, and one general draftsman. Address, stating age, experience, and salary expected, E. C. Means, 35 Race st., Allegheny City, Pa.

Wanted, Machinist—A good bench hand for work about like sewing machine adjusting; good wages to right man. Address, with ref., stating age, and wages wanted, Metric Metal Co., Beaver Falls, Pa.

Pattern Maker—First-class workman wants to make a change; eight years in present position in leading New York jobbing shop; expert on steam, water, and electric work. Accurate, AM. MACHINIST.

Wanted—An active and persevering man of good character to travel and solicit orders for steam engines and general machinery. Address, stating age, experience, and salary expected, Homo Ferro, care AMERICAN MACHINIST.

Wanted—A good all-around machinist, close fitting on light specialties; must have faculty for doing good work systematically; give ref., exp., and wages; steady work to right man. Standard Machine Co., Weedsport, N. Y.

Wanted—By a foundry and machine works with rapidly growing trade, a thorough moulder or machinist with from $3,000 to $5,000, to take an interest in the business, and act as foreman; must be a thorough mechanic. Address R. J., AM. MACHINIST.

Wanted—A thoroughly competent and 1st class machinist as foreman in engine, mill, and general mach. shops. None but a strictly first-class man who is a pusher, and has had experience in such capacity, need apply. Address "Machinist" Joliet, Ill.

Wanted—By a manufacturing establishment, an energetic traveling salesman of experience to sell steam pumps, boiler feeders, brass and iron body valves, fittings, and general supplies used by engine builders, boiler makers, steam and gas fitters, and to the jobbing trade. State experience and section of country best acquainted; also give reference. Address "Steam Pumps," care AMERICAN MACHINIST.

Wanted—A mechanical foreman, by a responsible manufacturing company in Conn., to take charge of their machine shop and brass department for the manufacture of steam and gas fitters' and steam users' supplies and tools; must be a good general mechanic of ability, with experience in these or similar lines, capable of designing tools for cheapening costs, and skilled in managing help. Address, stating particulars, Box 108, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d hand Bolt Cutters. S. M. York, Clevld., O.

Koopman's Scales for quick measurements.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, O.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

Send for catalogue of Model Engines, Castings, Electric Bells, etc., Lowell Model Co., 170 Merrimack st., Lowell, Mass.

Wanted—A planing machine, 48"x10 ft.; must be in good order and a bargain. Address Box 114, AMERICAN MACHINIST.

Designs and working drawings for special machinery, tools, etc. attended to by experienced draftsman. "Draftsman," Box 107, AM. MACHINIST.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Wanted—To contract for the manufacture of a small article of sheet steel No. 22, requiring stamping out, fitting and nickel plating. Address Box 110, AMERICAN MACHINIST.

Wanted—To sell patent or have manufactured on royalty, lathe chuck illustrated in AM. MACHINIST, Sept. 22d, '88. This is a thoroughly practical tool, and in demand, and well worth investigation. Address Chuck, care AMERICAN MACHINIST.

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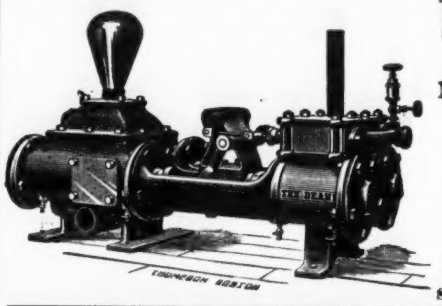

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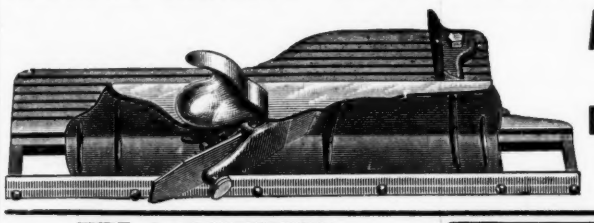

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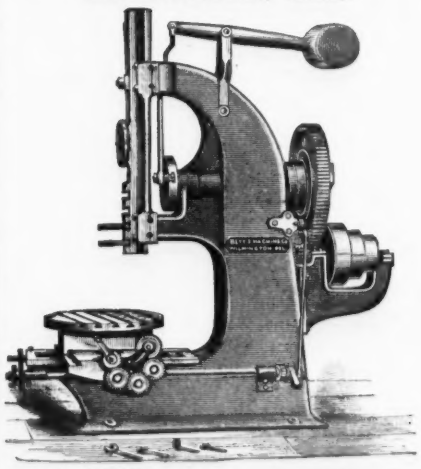

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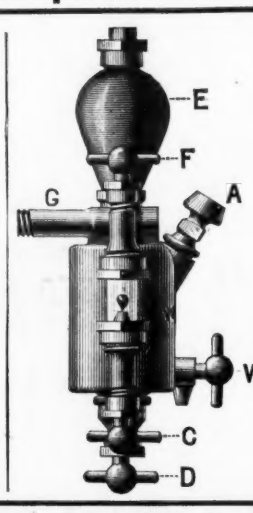

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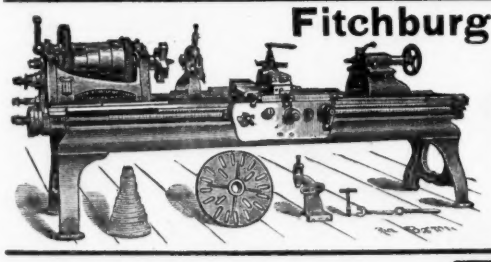

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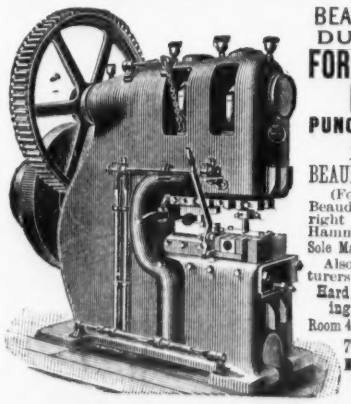

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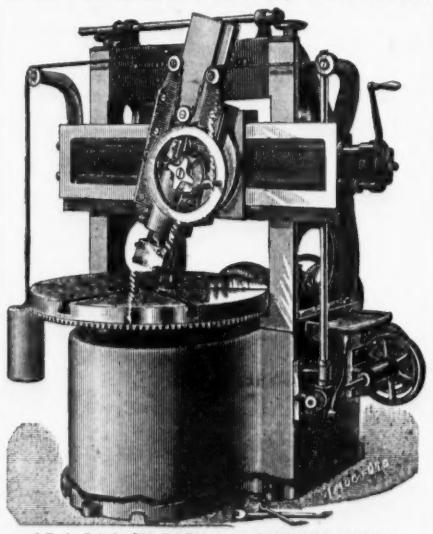

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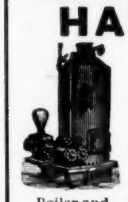

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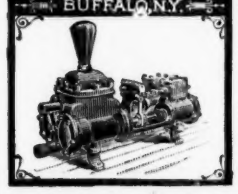

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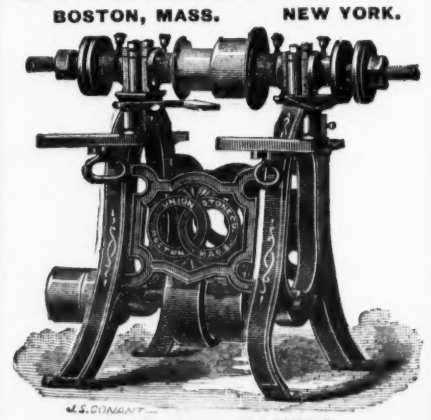

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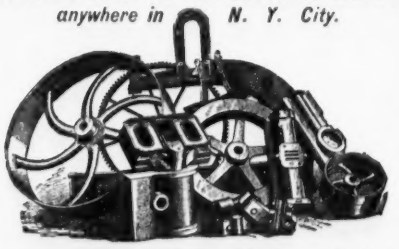

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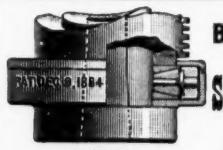

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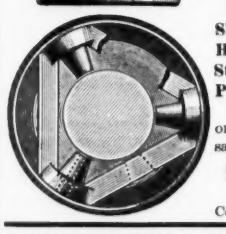

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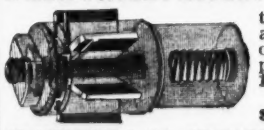

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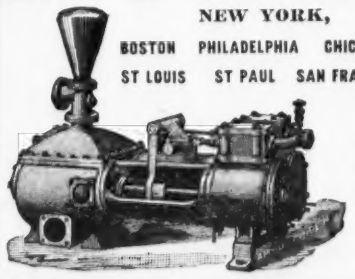

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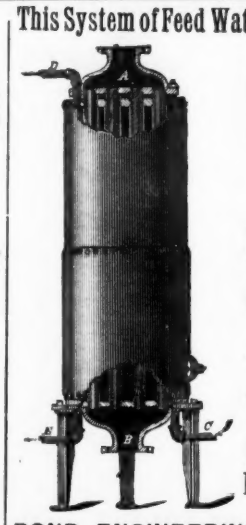

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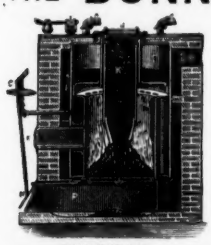

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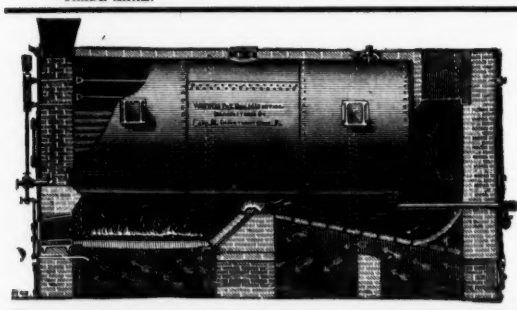

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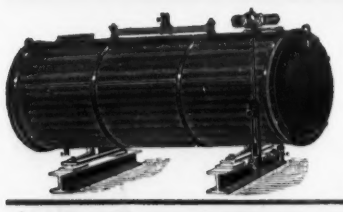

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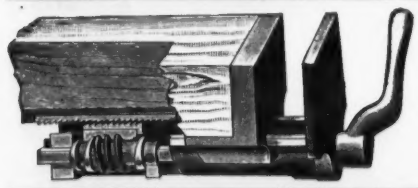

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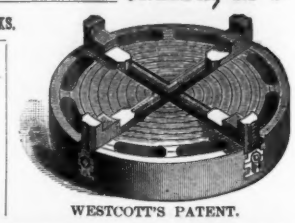

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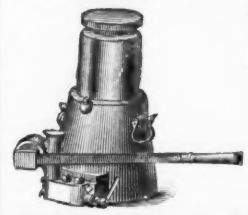

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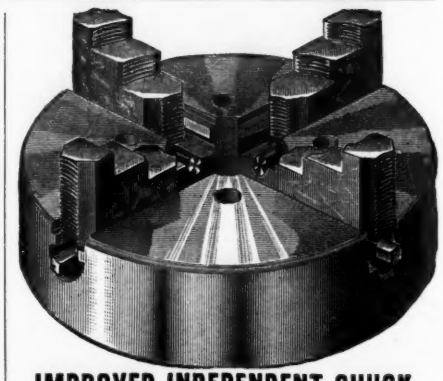

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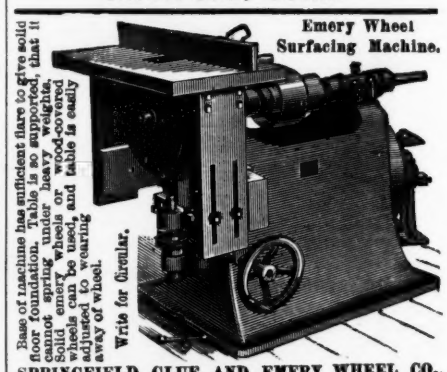

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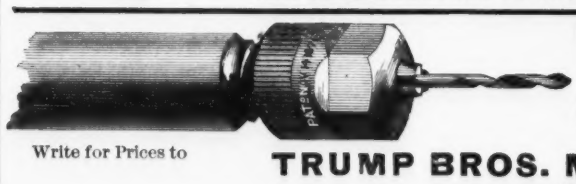

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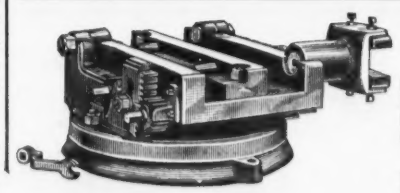

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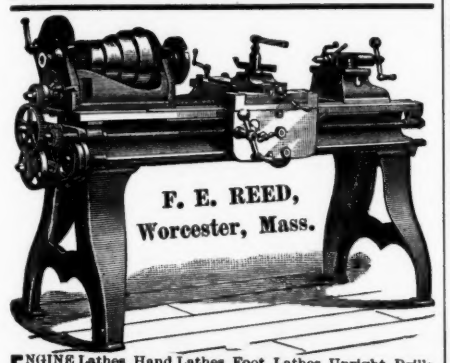

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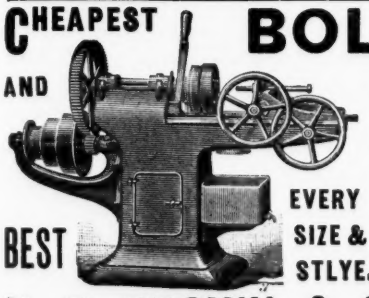

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1	" "	11″	"	5 ft. "
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7	Blaisdell Lathes	16″	swing,	6 ft. bed.
8	" "	16″	"	8 ft. "
2	Dexter Lathes	16″	"	6 ft. "
1	" "	16″	"	8 ft. "
1	Flather Lathe	16″	"	6 ft. "
1	"	18″	"	8 ft. "
1	Blaisdell "	18″	"	8 ft. "
1	" "	18″	"	10 ft. "
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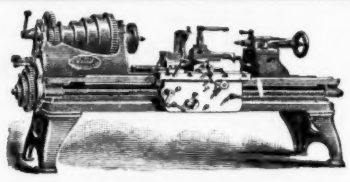

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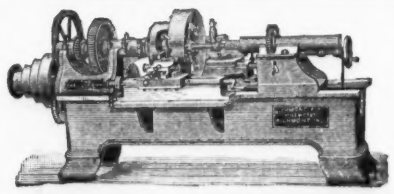

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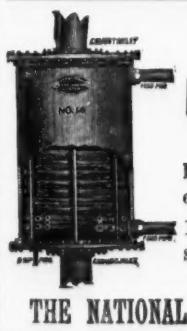

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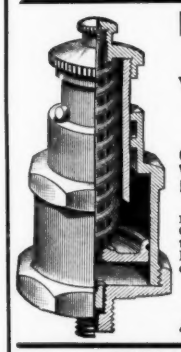

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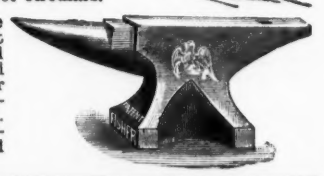

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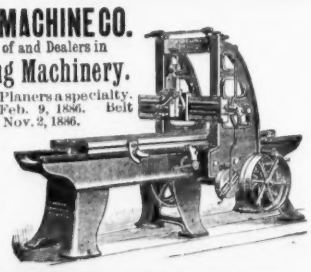

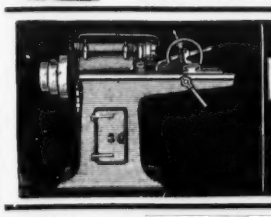

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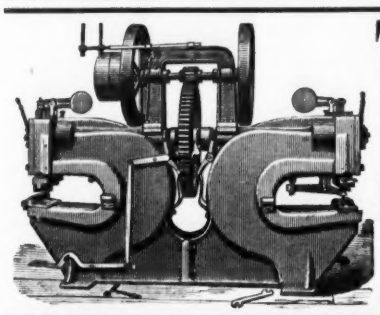

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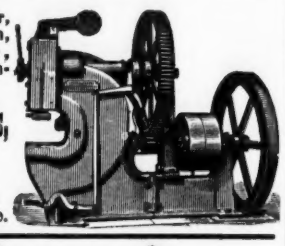

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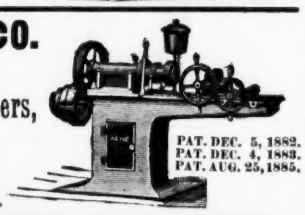

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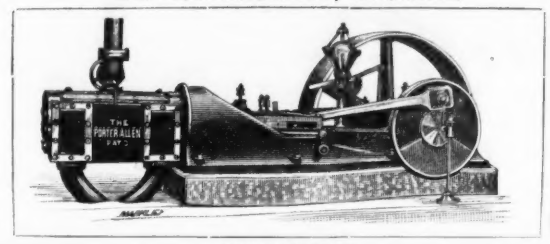

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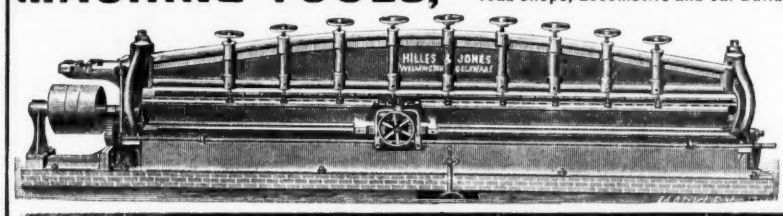

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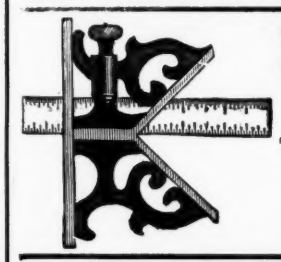

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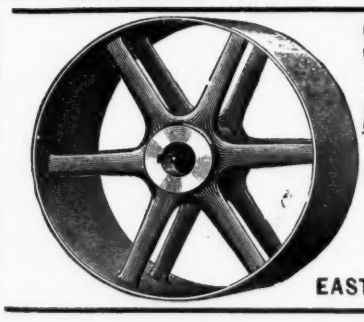

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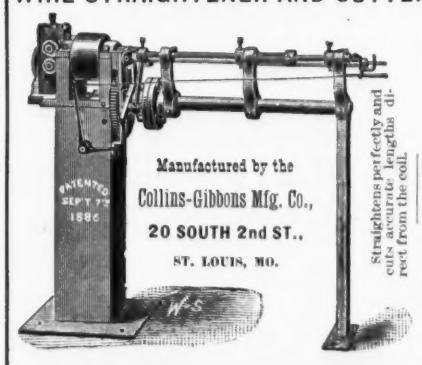
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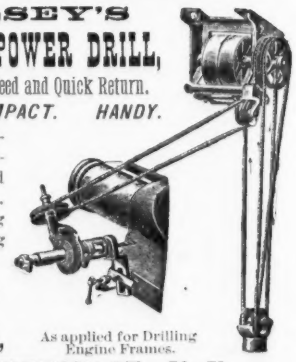

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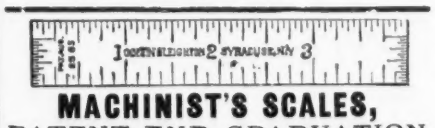

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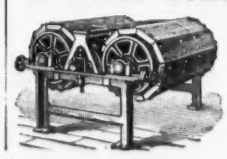

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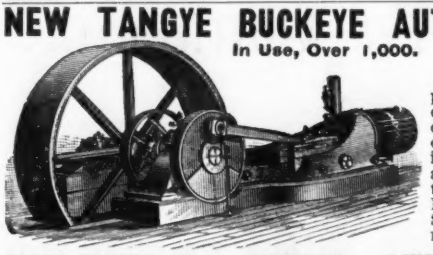

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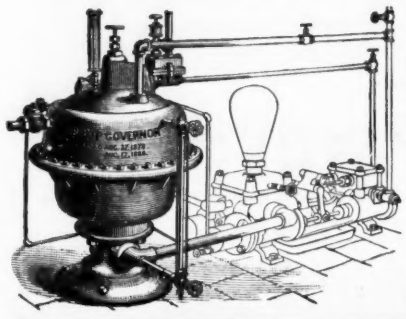

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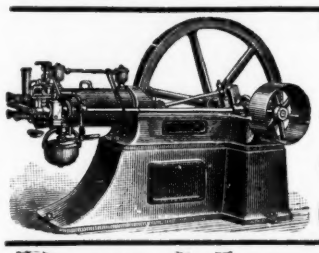

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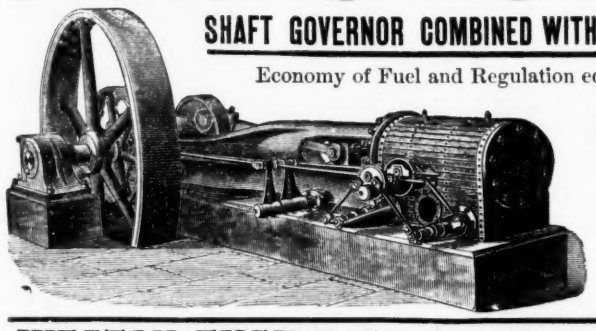

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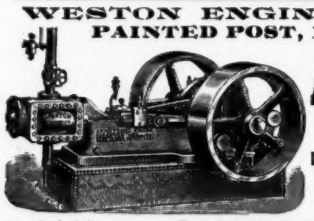

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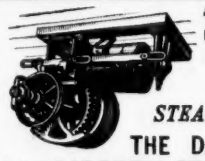

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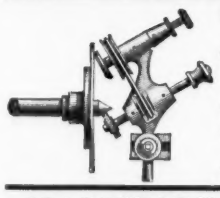

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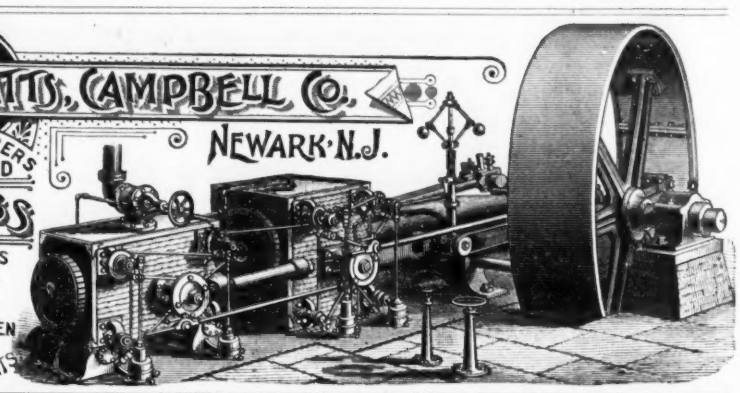

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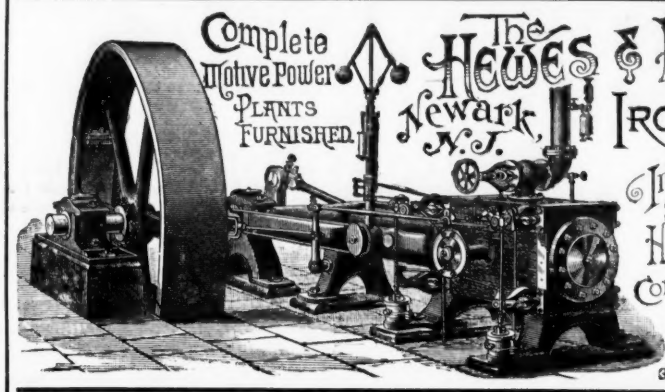

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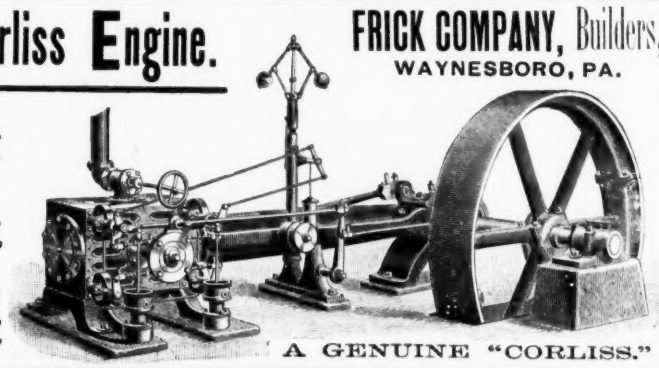

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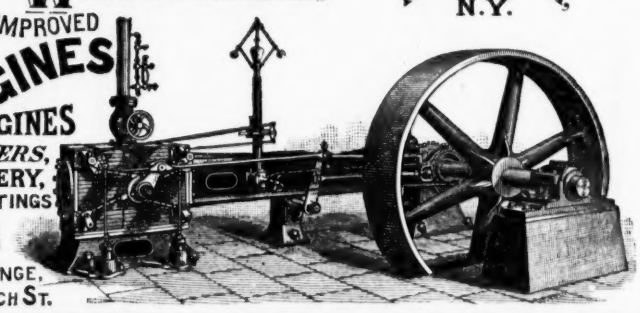

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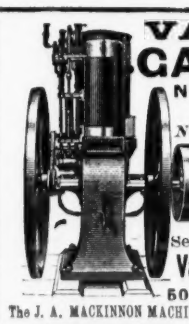

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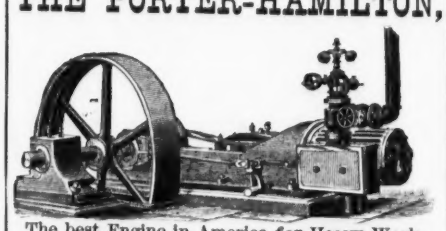

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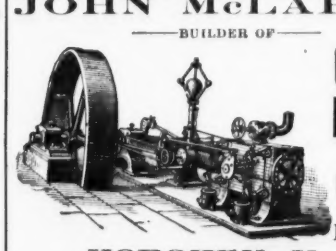

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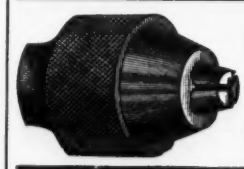

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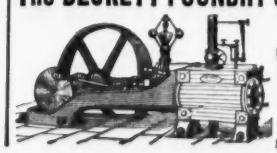

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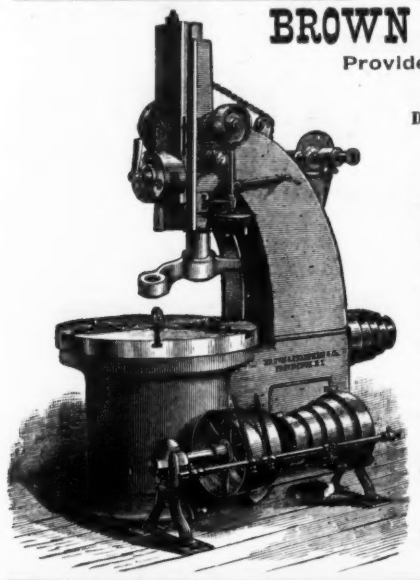

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With this Machine from two to four times as much work can be accomplished in a given time as can be done upon an Engine Lathe, and in a much superior manner, the work being more easily trued and fastened in place than upon any machine having a horizontal spindle, and the different tools in the turret-head easily brought into operation in succession, while, from the perpendicular position of the same, the chips fall through the center of spindle of revolving table to the floor, causing no trouble by clogging of reamers, &c.

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The Revolving Table is driven by a 5-step cone for 3 in. belt, and geared 6 to 1. Steps of cone so graded as to make cutting speed uniform for 5 different diameters of holes.

The Turret has 4 holes 1 3-4 in. in diameter, and is securely clamped in position. An adjustable dog allows the locking pin to be withdrawn at any part of its upward motion.

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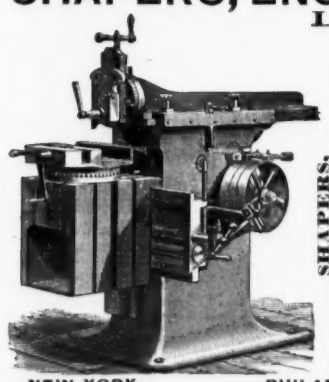

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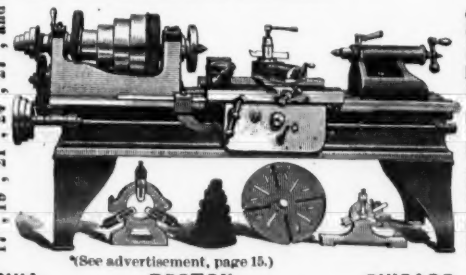

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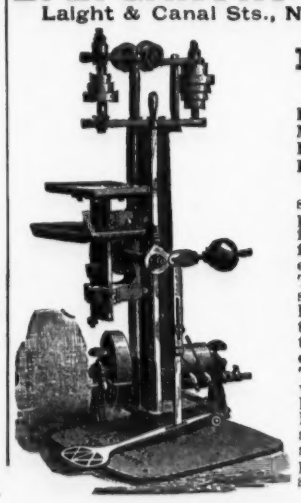

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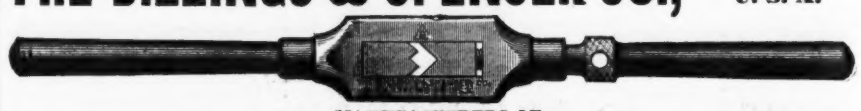

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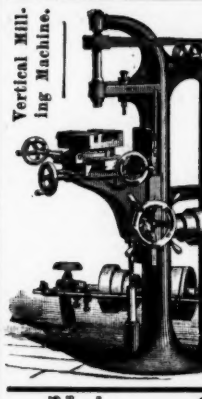

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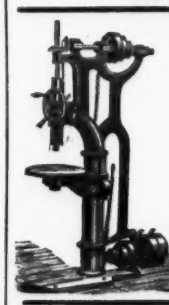

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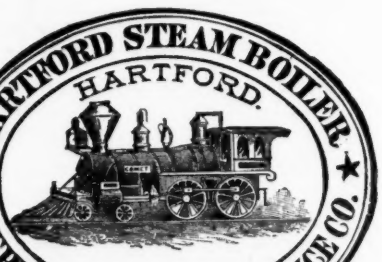

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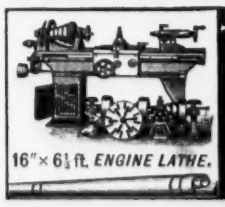

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